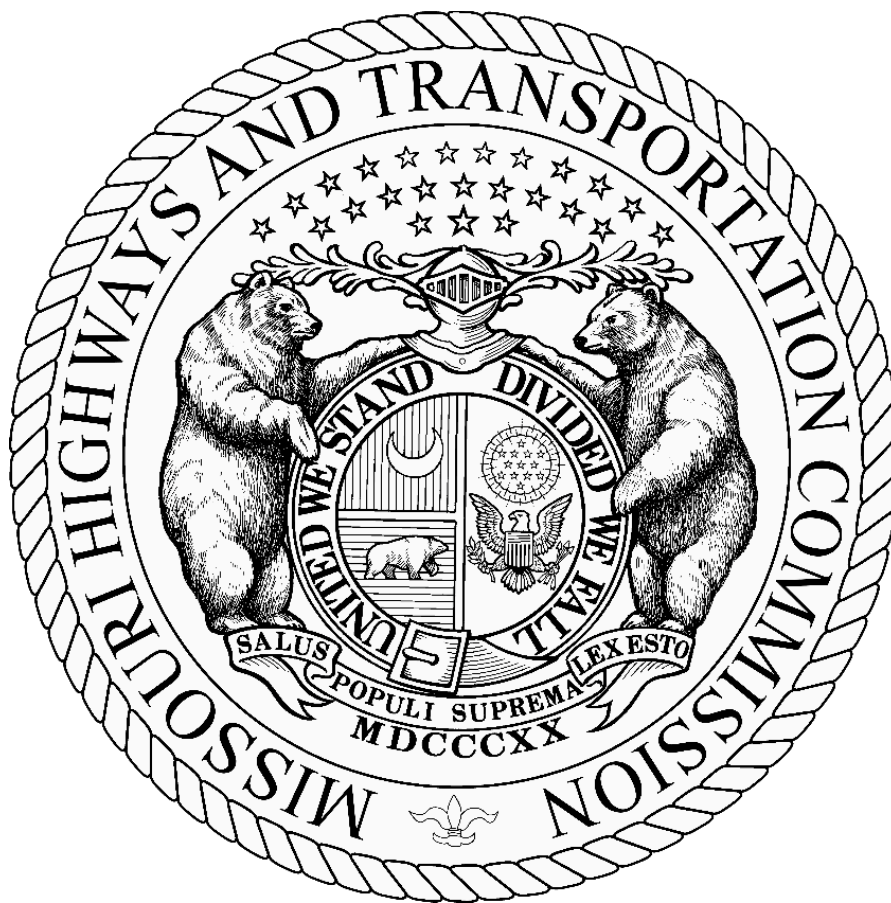




**MISSOURI
HIGHWAYS and TRANSPORTATION
COMMISSION**

JEFFERSON CITY, MISSOURI

**GENERAL PROVISIONS AND
SUPPLEMENTAL SPECIFICATIONS TO 2026
MISSOURI STANDARD SPECIFICATIONS FOR
HIGHWAY CONSTRUCTION**

Effective January 1, 2027

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<p>MISSOURI HIGHWAY AND TRANSPORTATION COMMISSION 105 W. Capitol Ave. Jefferson City, MO 65102 1-888-275-6636</p>	<div data-bbox="673 504 1015 850"> </div> <div data-bbox="657 861 1031 997"> <p>Eric Schroeter, P.E.</p> <p>Digitally signed by Eric Schroeter, P.E. Date: 2026.10.21 13:29:34 -05'00'</p> </div>	<p>Effective Date: <u>01/01/2027</u></p>
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GENERAL PROVISIONS

DIVISION 100

SECTION 404 NATIONWIDE PERMIT GENERAL CONDITIONS

04/17

General Conditions. The following general conditions shall be followed in order for authorization by a Nationwide Permit (NWP) to be valid. Permit authorization from U.S. Army Corps of Engineers (USACE) may have additional conditions that will be binding to the project. The contractor shall refer to the permit authorization letter included in the contract.

1.0 Navigation. No activity shall cause more than a minimal adverse effect on navigation.

2.0 Aquatic Life Movements. No activity shall substantially disrupt the necessary life-cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3.0 Spawning Areas. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practical. Activities that result in the physical destruction (e.g., through excavation, fill or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4.0 Migratory Bird Breeding Areas. Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5.0 Suitable Material. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

6.0 Water Supply Intakes. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

7.0 Adverse Effects from Impoundments. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

8.0 Management of Water Flows. To the maximum extent practicable, the pre-construction course, condition, capacity and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the preconstruction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

9.0 Fills Within 100-Year Floodplains. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

10.0 Equipment. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures shall be taken to minimize soil disturbance.

11.0 Soil Erosion and Sediment Controls. Appropriate erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the US during periods of low-flow or no-flow.

12.0 Removal of Temporary Fills. Temporary fills must be completely removed in their entirety and the affected areas returned to the pre-construction elevations. The affected areas must be revegetated, as appropriate.

13.0 Wild and Scenic Rivers. No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation, or study status.

14.0 Tribal Rights. No NWP activity may cause more than minimal adverse effects on tribal rights (including treaty rights), protected tribal resources, or tribal lands.

15.0 Endangered Species No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act, or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which “may affect” a listed species or critical habitat, unless ESA section 7 consultation addressing the effects of the proposed activity has been completed. Direct effects are the immediate effects on listed species and critical habitat caused by the NWP activity. Indirect effects are those effects on listed species and critical habitat that are caused by the NWP activity and are later in time, but still are reasonably certain to occur. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have “no effect” on listed species or critical habitat, or until ESA section 7 consultation has been completed.

16.0 Migratory Birds and Bald and Golden Eagles. The permittee is responsible for ensuring their action complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory birds or eagles, including whether “incidental take” permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

17.0 Historic Properties. In cases where the USACE District Engineer determines that the activity may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

18.0 Mitigation. The project must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the U.S. to the maximum extent practicable at the project site (i.e., on site).

19.0 Regional and Case-by-Case Conditions. The contractor’s activity shall comply with any regional conditions that may have been added to the contract by the USACE Division Engineer, (see 33 CFR 330.4(e)), and with any case-specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its Section 401 water quality certifications.

20.0 Activities Affecting Structures or Works Built by the United States. If an NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a USACE federally authorized Civil Works project (a “USACE project”), the prospective permittee must submit a preconstruction notification. See paragraph (b)(10) of general condition 32. An activity that requires Section 408 Permission is not authorized by NWP until the appropriate Corps office issues the section 408 permission to alter, occupy, or use the USACE project, and the USACE District Engineer issues a written NWP verification.

21.0 Section 404 Conditions. In addition to the General Conditions, the following conditions will apply only to activities that involve the discharge of dredged or fill material into waters of the US, and shall be followed to maintain compliance with the NWP authorization.

21.1 Section 404 Nationwide Permit No. 3.

21.1.1 The repair, rehabilitation, or replacement of any previously authorized, currently serviceable, structure or fill, or of any currently serviceable structure or fill authorized by 33 CFR 330.3, provided that the structure or fill is not to be put to uses differing from those uses specified or contemplated for the fill in the original permit or the most recently authorized modification. Minor deviations in the structure's configuration or filled area, including those due to changes in material, construction techniques, requirements of other regulatory agencies, or current construction codes or safety standards that are necessary to make the repair, rehabilitation, or replacement are authorized. This NWP also authorizes the removal of previously authorized structures or fills. Any stream channel modification is limited to the minimum necessary for the repair, rehabilitation, or replacement of the structure or fill; such modifications, including the removal of material from the stream channel, must be immediately adjacent to the project. This NWP also authorizes the removal of accumulated sediment and debris within, and in the immediate vicinity of, the structure or fill. This NWP also authorizes the repair, rehabilitation, or replacement of those structures or fills destroyed or damaged by storms, floods, fire or other discrete events, provided the repair, rehabilitation, or replacement is commenced, or is under contract to commence, within two years of the date of their destruction or damage. In cases of catastrophic events, such as hurricanes or tornadoes, this two-year limit may be waived by the district engineer, provided the permittee can demonstrate funding, contract, or other similar delays.

21.1.2 This NWP also authorizes the removal of accumulated sediments and debris outside the immediate vicinity of existing structures (e.g., bridges, culverts road crossings, water intake structures, etc.). The removal of sediment is limited to the minimum

necessary to restore the waterway in the vicinity of the structure to the approximate dimensions that existed when the structure was built, but cannot extend farther than 200 feet in any direction from the structure. This 200-foot limit does not apply to maintenance dredging to remove accumulated sediments blocking or restricting outfall and intake structures or to maintenance dredging to remove accumulated sediments from canals associated with outfall and intake structures. All dredged or excavated materials must be deposited and retained in an area that has no waters of the United States unless otherwise specifically approved by the district engineer under separate authorization.

21.1.3 This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the maintenance activity. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. After conducting the maintenance activity, temporary fills must be removed in their entirety and the affected areas returned to preconstruction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

21.2 Section 404 Nationwide Permit No. 12. Activities required for the construction, maintenance and repair of utility lines and associated facilities in waters of the U.S. shall be as follows.

21.2.1 Utility lines. This NWP authorizes discharges of dredged or fill material into waters of the United States and structures or work in navigable waters for crossings of those waters associated with the construction, maintenance, or repair of utility lines, including outfall and intake structures. There must be no change in pre-construction contours of waters of the United States. A “utility line” is defined as any pipe or pipeline for the transportation of any gaseous, liquid, liquescent, or slurry substance, for any purpose, and any cable, line, or wire for the transmission for any purpose of electrical energy, telephone, and telegraph messages, and internet, radio and television communication. The term “utility line” does not include activities that drain a water of the United States, such as drainage tile or french drains, but it does apply to pipes conveying drainage from another area. Material resulting from trench excavation may be temporarily sidecast into waters of the U.S. for no more than three months, provided that the material is not placed in such a manner that it is dispersed by currents or other forces. The USACE District Engineer may extend the period of temporary side casting for no more than a total of 180 days, where appropriate. In wetlands, the top 6 to 12 inches of the trench should normally be backfilled with topsoil from the trench. The trench cannot be constructed or backfilled in such a manner as to drain waters of the U.S. (e.g., backfilling with extensive gravel layers, creating a french drain effect). Any exposed slopes and stream banks shall be stabilized immediately upon completion of the utility line crossing of each waterbody.

21.2.2 Utility line substations. This NWP authorizes the construction, maintenance, or expansion of substation facilities associated with a power line or utility line in non-tidal waters of the United States, provided the activity, in combination with all other activities included in one single and complete project, does not result in the loss of greater than 1/2-acre of waters of the United States.

21.2.3 Foundations for Overhead Utility Line Towers, Poles, and Anchors. This NWP authorizes the construction or maintenance of foundations for overhead utility line towers, poles, and anchors in all waters of the U.S., provided the foundations are the minimum size necessary and separate footings for each tower leg (rather than a larger single pad) are used where feasible.

21.2.4 Access Roads. This NWP authorizes the construction of access roads for the construction and maintenance of utility lines, including overhead power lines and utility line substations, in non-tidal waters of the US, provided the activity, in combination with all other activities included in one single and complete project, does not cause the loss of greater than 1/2 acre of non-tidal waters of the U.S. Access roads shall be the minimum width necessary. Access roads must be constructed so that the length of the road minimizes any adverse effects on waters of the US and must be as near as possible to preconstruction contours and elevations (e.g., at grade corduroy roads or geotextile/gravel roads). Access roads constructed above preconstruction contours and elevations in waters of the U.S. must be properly bridged or culverted to maintain surface flows. This NWP authorizes, to the extent that Department of the Army authorization is required, temporary structures, fills, and work necessary for the remediation of inadvertent returns of drilling fluids to waters of the United States through sub-soil fissures or fractures that might occur during horizontal directional drilling activities conducted for the purpose of installing or replacing utility lines. These remediation activities must be done as soon as practicable, to restore the affected waterbody. District engineers may add special conditions to this NWP to require a remediation plan for addressing inadvertent returns of drilling fluids to waters of the United States during horizontal directional drilling activities conducted for the purpose of installing or replacing utility lines. This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the utility line activity. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. After construction, temporary fills must be removed in their entirety and the affected areas returned to preconstruction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

21.3 Section 404 Nationwide Permit No. 13. The following bank stabilization activities will be necessary for erosion prevention

provided the activity meets all of the following criteria.

21.3.1 No material is placed in excess of the minimum needed for erosion protection.

21.3.2 The bank stabilization activity is no more than 500 feet in length.

21.3.3 The activity will not exceed an average of one cubic yard per running foot as measured along the length of the treated bank, below the plane of the ordinary high water mark or the high tide line, unless the district engineer waives this criterion by making a written determination concluding that the discharge will result in no more than minimal adverse environmental effects.

21.3.4 No material is placed in any special aquatic site, including wetlands. Special aquatic sites include wildlife sanctuaries and refuges, wetland, mudflats, vegetated shallow and riffle and pool complexes.

21.3.5 No material is of the type, or is placed in any location, or in any manner, to impair surface water flow into or out of any waters of the U.S.

21.3.6 No material is placed in a manner that will be eroded by normal or expected high flows (properly anchored trees and treetops may be used in low energy areas).

21.3.7 Native plants appropriate for current site conditions, including salinity, must be used for bioengineering or vegetative bank stabilization.

21.3.8 This NWP shall not be used for the channelization of a water of the U.S.

21.4 Section 404 Nationwide Permit No. 14. Activities required for the construction, expansion, modification, or improvement of linear transportation projects (e.g., roads, highways, railways, trails, airport runways, and taxiways) in waters of the US if the activity meets the following criteria.

21.4.1 The discharge does not cause the loss of greater than 1/2-acre of waters of the US.

21.4.2 Any stream channel modification, including bank stabilization, is limited to the minimum necessary to construct or protect the linear transportation project; such modifications must be in the immediate vicinity of the project.

21.4.3 This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to construct the linear transportation project. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. Temporary fills must be removed in their entirety and the affected areas returned to preconstruction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

21.5 Section 404 Nationwide Permit No. 15. Discharges of dredged or fill material incidental to the construction of bridges across navigable waters of the U.S., including cofferdams, abutments, foundation seals, piers, and temporary construction and access fills provided the construction of the bridge structure has been authorized by the U.S. Coast Guard under Section 9 of the Rivers and Harbors Act of 1899 or other applicable laws. Causeways and approach fills are not to be included in this NWP and will require a separate Section 404 permit.

21.6 Section 404 Nationwide Permit No. 23. Activities undertaken, assisted, authorized, regulated, funded, or financed, in whole or in part, by another Federal agency or department where that agency or department has determined, pursuant to the Council on Environmental Quality's implementing regulations for the National Environmental Policy Act (40 CFR Part 1500 et seq.), that the activity is categorically excluded from the requirement to prepare an environmental impact statement or environmental assessment analysis, because it is included within a category of actions which neither individually nor cumulatively have a significant effect on the human environment, and the USACE Office of the Chief of Engineers (ATTN: CECW-OR) has concurred with that agency's or department's determination that the activity is categorically excluded and approved the activity for authorization under NWP23.

21.7 Section 404 Nationwide Permit No. 33. Temporary structures, work and discharges, including cofferdams, necessary for construction activities or access fills or dewatering of construction sites; provided that the associated primary activity is authorized by the USACE or the U.S. Coast Guard. This NWP also authorizes temporary structures, work, and discharges, including cofferdams, necessary for construction activities not otherwise subject to the Corps or U.S. Coast Guard permit requirements. Appropriate measures shall be taken to maintain near normal downstream flows and to minimize flooding. Fill must consist of materials and placed in a manner that will not be eroded by expected high flows. The use of dredged material may be allowed if the USACE District Engineer determines that it will not cause more than minimal adverse effects. Following completion of construction, temporary fill must be entirely removed to areas an area that has no waters of the U.S., dredged material must be

returned to its original location, and the affected areas must be restored to pre-construction elevations. Cofferdams shall not be used to dewater wetlands or other aquatic areas changing the use of these areas. The affected areas must also be revegetated, as appropriate. This permit does not authorize the use of cofferdams to dewater wetlands or other aquatic areas to change their use. Structures left in place after cofferdams are removed will require a Section 10 permit if located in navigable waters of the U. S. (See 33 CFR, Part 322).

SECTION 401 WATER QUALITY CERTIFICATION CONDITIONS

04/17; 04/22; 10/26

1.0 Description. When a Clean Water Act Section 404 Nationwide Permit is in effect, the contractor is automatically permitted to perform this work under a Water Quality Certification (Section 401) by the Missouri Department of Natural Resources (MDNR). The contractor shall adhere to the following conditions:

1.1 Missouri Water Quality Standards antidegradation requirements dictate all appropriate and reasonable Best Management Practices (BMPs) related to erosion and sediment control, project stabilization, and prevention of water quality degradation are applied and maintained [10 CSR 20-7.031(3)]; for example, preserving vegetation, streambank stability, and basic drainage. BMPs shall be properly installed prior to conducting authorized activities and maintained, repaired, and/or replaced as needed during all phases of the project to limit the amount of discharge of water contaminants to waters of the state. The project shall not involve more than normal stormwater or incidental loading of sediment caused by project activities so as to comply with Missouri's general water quality criteria [10 CSR 20-7.031(4)]; [also see MoDOT Engineering Policy Guide (EPG) Sections 127.29 and 136.6.4.8].

1.2 Temporary stream crossings shall be sized and placed appropriately and shall not create an impediment to the passage of aquatic organisms and/or sediment. This will ensure compliance with the Missouri Water Quality Standards general criterion requiring waters to be free from physical or hydrologic changes that would impair the natural biological community [10 CSR 20-7.031(4)(H)].

1.3 Stream channel modifications shall be avoided as much as possible and, if needed, shall be minimized. Where modifications are necessary for highway design safety or protection of state infrastructure, to the extent practicable, the project shall incorporate natural channel design features relative to a morphologically stable and appropriate stream channel and incorporate measures such as grade control, in-stream habitat, riparian plantings, etc. This will ensure compliance with the Missouri antidegradation requirement that waters of the state shall be maintained and protected [10 CSR 20-7.031(3)] under Missouri Clean Water Law, which provides the Department authority to adopt remedial measures to prevent, control, or abate pollution [Section 644.026.1(9)].

1.4 The following materials are not suitable where contact with water is expected and shall not be used due to their potential to cause violations of the general criteria of Missouri's Water Quality Standards [10 CSR 20-7.031(4)]: earthen fill, gravel, and broken concrete where the material does not meet the Suitable Material specifications stated in the "Missouri Nationwide Permit Regional Conditions" (<https://www.nwk.usace.army.mil/Missions/Regulatory/Nation-Wide-Permits/>) in locations where erosive flows are expected to occur on a regular basis, such as streambanks and/or lake shorelines; asphalt; concrete with exposed rebar; tires, vehicles or vehicle bodies, and construction or demolition debris are solid waste and are excluded from placement in the waters of the state, but properly sized, broken concrete without exposed rebar is allowed; liquid concrete, including grouted riprap, if not placed in forms as part of an engineered structure; material containing chemicals that would result in violation of Missouri Water Quality Standards general criteria [10 CSR 20-7.031(4)] or specific criteria [10 CSR 20-7.031(5)].

1.5 Waste concrete or concrete rinsate shall be disposed of in a manner that does not result in any discharge to the jurisdictional water ways. This will ensure compliance with the Missouri Water Quality Standards general criteria requiring waters be free from unsightly bottom deposits [10 CSR 20-7.031(4)(A)]; substances resulting in toxicity [10 CSR 20-7.031(4)(D)]; and physical, chemical, or hydrologic changes that would impair the natural biological community [10 CSR 20-7.031(4)(H)].

1.6 During construction, clearing of vegetation shall be kept to the minimum necessary to accomplish the project except for the removal of invasive or noxious species and placement of ecologically beneficial practices. This will ensure compliance with the Missouri antidegradation requirement for BMPs [10 CSR 20-7.031(3)].

1.7 Care shall be taken to keep machinery out of the water way as much as possible. If work in the water way is unavoidable, it shall be performed in a way that minimizes the duration and amount of any disturbance to banks, substrate and vegetation to prevent

increases in turbidity. Fuel, oil and other petroleum products, equipment, construction materials and any solid waste shall not be stored below the ordinary high water mark at any time. All precautions shall be taken to avoid the release of wastes or fuel to streams and other adjacent waters as a result of this operation. This will ensure compliance with the Missouri Water Quality Standards antidegradation requirement for Best Management Practices [10 CSR 20-7.031(3)] and Missouri Water Quality Standards general criteria requiring waters be free from substances preventing beneficial uses [10 CSR 20-7.031(4)(A)]; substances causing unsightly color or turbidity [10 CSR 20-7.031(4)(C)]; and physical, chemical or hydrologic changes that would impair the natural biological community [10 CSR 20-7.031(4)(H)].

1.8 Disturbed riparian areas, banks, etc., shall be restored to a stable condition to protect water quality as soon as possible. This will ensure compliance with the Missouri antidegradation requirement for BMPs [10 CSR 20-7.031(3)].

1.9 All efforts shall be made to minimize exposure of unprotected soils. To the best of MoDOT's or its contractor's ability, project activity shall be conducted at times of little or no rainfall to limit the amount of overland flow as well as sediment disturbance and transport caused by heavy equipment. This will ensure compliance with the Missouri antidegradation requirement for BMPs [10 CSR 20-7.031(3)] and general criteria [10 CSR 20-7.031(4)].

1.10 Any stockpiled excess material resulting from the project shall be managed with appropriate BMPs or removed from the site and placed beyond the high bank on a non-wetland site. This will ensure compliance with the Missouri Water Quality Standards antidegradation requirement that waters of the state shall be maintained and protected [10 CSR 20-7.031(3)] and general criterion requiring waters to be free from physical, chemical, or hydrologic changes that would impair the natural biological community [10 CSR 20-7.031(4)(H)].

1.11 Petroleum products spilled into any water or on the banks where the material may enter waters of the state shall be cleaned up immediately and disposed of properly. Spills of any amount of petroleum in a waterway shall be reported as soon as possible, but no later than 24 hours after discovery, to the Department's Environmental Emergency Response phone line at 573-634-2436 or website at <https://dnr.mo.gov/waste-recycling/investigations-cleanups/environmental-emergency-response>. This will ensure compliance with Missouri Environmental Improvement Authority [Section 260.015, RSMo] to provide for the conservation of state water resources by the prevention of pollution and proper methods of disposal and Missouri Water Quality Standards general criteria requiring waters be free from substances that prevent maintenance of beneficial uses; cause unsightly color, turbidity, or toxicity; and/or impair the natural biological community [10 CSR 20-7.031(4)].

DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM REQUIREMENTS

04/21; 07/22; 04/23; 10/24; 07/25

1.0 Program Applicability. The subsequent sections will apply only to contracts involving U.S. Department of Transportation (USDOT) federal-aid or federal funded participation. Federal-aid or federal funded participation includes, but is not limited to, any funds directly or indirectly received by MoDOT, or authorized for distribution to or through MoDOT, by the USDOT or any operating administration within the USDOT. These provisions will not apply to Commission contracts funded exclusively with state funds, or state and local funds. Any contractor, subcontractor, supplier, DBE firm, and contract surety involved in the performance of a federal-aid contract shall be aware of and fully understand the terms and conditions of the USDOT DBE Program, as the terms appear in Title 49 CFR Part 26 (as amended), the USDOT DBE Program regulations; Title 7 CSR Division 10, Chapter 8 (as amended), and the Commission's DBE Program rules.

2.0 DBE Program Distinguished from Other Affirmative Action Programs. The USDOT DBE Program established by the U.S. Congress is not the same as, and does not involve or utilize, any of the elements or authority of other state or local affirmative action programs, nor does the program rely upon state legislation or gubernatorial executive orders for implementation or authorization, other than the general authority given the Commission in Section 226.150, RSMo. The USDOT DBE Program is implemented by the Commission and MoDOT, through and in conjunction with the FHWA, FTA and FAA, as a "recipient" defined in Title 49 CFR 26.5.

3.0 Policy Regarding DBE Firms. It is the policy of the U. S. Department of Transportation and MoDOT that businesses owned by socially and economically disadvantaged individuals have an opportunity to participate in the performance of contracts funded in whole or in part with federal funds. Consequently, the requirements of 49 CFR Part 26 (as amended) and the Commission's implementing state regulations in Title 7 CSR Division 10, Chapter 8, "Disadvantaged Business Enterprise Program", will apply to any contract funded in whole or part with federal funds.

4.0 Opportunity for DBEs to Participate. Each contractor, subcontractor and supplier working on a contract funded in whole or in part with federal funds shall take all necessary and reasonable steps to ensure that DBEs have an opportunity to compete for and participate in performance on project contracts and subcontracts in which a DBE goal is established.

5.0 Required Contract Provision. The federal-aid contract will include the following provision, as mandated by USDOT at Title 49 CFR 26.13(b):

- (a) The contractor, sub-recipient or subcontractor shall not discriminate based on race, color, religion, national origin, or sex in the performance of the contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of USDOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of the contract, which may result in the termination of the contract or such other remedy, as the recipient deems appropriate.

In this provision, “contractor” will be defined as the contractor on the contract; sub-contractor, or material supplier performing the work on or for the project. For the purposes of any federal-aid contract awarded by the Commission, “the recipient” will be defined as either the Commission, or MoDOT, or both. The contractor shall include this same contract provision in every supply contract or subcontract the contractor makes or executes.

6.0 DBE Program Information. DBE Program information may be obtained from the MoDOT Business Development and Compliance Division, 105 W. Capitol Avenue, P.O. Box 270, Jefferson City, Missouri 65102-0270. Phone (573) 526-2978, Fax (573) 526-0558, E-Mail: dbec@modot.mo.gov. It will be the duty of each contractor, and for the contractor’s subcontractors to take the steps necessary to determine the legal obligations and limitations under the DBE Program, as an element of responsibility. It will be the duty of each certified DBE firm to know, understand and comply with the DBE firm’s legal obligations and limitations under the DBE Program, as a requirement of program participation.

7.0 DBE Certification, and the Missouri Unified Certification Program. MoDOT and other certifying agencies within Missouri have partnered to form the Missouri Regional Certification Committee (MRCC) and have developed a Unified Certification Program (UCP) pursuant to 49 CFR 26.81 and 7 CSR 10-8.061. Only DBE firms certified by the MRCC are eligible to perform work on a federal-aid contract for DBE contract goal credit. It is the contractor’s responsibility to ensure firms identified for participation are approved certified DBE firms. The MRCC DBE Directory can be found at the following link: <https://www.modot.org/welcome-business-development-and-compliance>.

8.0 DBE Program-Related Certifications Made by Bidders and Contractors. By submitting a bid on any call involving USDOT federal funded participation, and by entering into any contract on the basis of that bid, the contractor makes each of the following DBE Program-related certifications and assurances to USDOT, to the Commission, and to MoDOT:

- (a) The bidder certifies that management and bidding officers have reviewed and understand the bidding and project construction and administration obligations of the USDOT DBE Program regulations at Title 49 CFR Part 26 (as amended), and the Commission’s DBE Program rules at Title 7 CSR Division 10, Chapter 8 (as amended).
- (b) The bidder agrees to ensure that certified DBE firms have a full and fair opportunity to participate in the performance of the contract funded in whole or in part with federal funds. The bidder certifies that all necessary and reasonable steps were taken to ensure that DBE firms have an opportunity to compete for and perform work on the contract. The bidder further certifies that the bidder not discriminate on the basis of race, color, age, national origin, religion or sex in the performance of the contract, or in the award of any subcontract.
- (c) The bidder certifies that if awarded the federal-aid contract, the contractor will make a good faith effort to utilize the certified DBE firms committed to with the awarded contract.
- (d) The bidder certifies, that if awarded the federal-aid contract with less than the original DBE contract goal proposed by the Commission in the bid documents, as a result of an approved good faith effort, the revised lower amount shall become the final DBE goal, and that goal will be used to determine any liquidated damages to be assessed at the completion of the project.
- (e) The bidder understands and agrees that if awarded the contract the contractor is legally responsible to ensure that the contractor and each DBE, comply fully with all regulatory and contractual requirements of the USDOT DBE Program, and that each DBE firm participating in the contract fully perform the designated tasks, with the DBE’s own forces and equipment, under the DBE’s own direct supervision and management. The bidder certifies, that if awarded the contract and if MoDOT or the Commission determine that the contractor, a DBE or any other firm retained by the contractor has failed to comply with the DBE Program requirements or federal or state DBE Program regulations, the Commission, through MoDOT, shall have the sole authority and discretion to determine the extent of the monetary value to which the DBE contract goals have not been met at the project completion, and to assess against and withhold monetary damages

from the contractor up to the full amount of that breach. The bidder further understands and agrees that this clause authorizes the Commission, through MoDOT, to determine and fix the extent of the damages caused by a breach of any contractual or regulatory DBE Program requirement and that the damage assessment will be enforced in addition to, and not in lieu of, any other general liquidated damages clause in the contract. By submitting a bid for a federal-aid contract, and by entering into a contract, the bidder irrevocably agrees to such an assessment of liquidated damages for DBE Program purposes, and authorizes the Commission and MoDOT to make such an assessment of liquidated damages against the contractor, and to collect that assessment from any sums due the contractor under the contract, or any other contract, or by other legal process. The bidder makes this certification, agreement and authorization on behalf of itself, for each federal-aid contract.

9.0 Designation of DBE firms to perform on contract. The bidder states and certifies that the DBE participation information submitted in the bid or within the contract designated time is true, correct and complete and that the information provided includes the names of all DBE firms that will participate in the contract, the specific line item (s) that each DBE firm will perform or partially perform, and the creditable dollar amounts of the participation of each DBE. The specific line item must reference the MoDOT line number and item number contained in the proposal. The bidder further states and certifies that the bidder has committed to use each DBE firm listed for the work shown to meet the DBE contract goal and that each DBE firm listed has clearly confirmed to the bidder that the DBE firm will participate in and perform the work, with the DBE's own forces.

(a) The bidder certifies the bidder's understanding that as the contractor on a contract funded in whole or in part by USDOT federal funds, the bidder may not unilaterally terminate, substitute for, or replace any DBE firm that was designated in the executed contract, in whole or in any part, with another DBE, any non-DBE firm or with the contractor's own forces or those of an affiliate, without the prior written consent of MoDOT. The bidder understands it must receive approval in writing from MoDOT for the termination of a DBE firm, or the substitution or replacement of a DBE before any substitute or replacement firm may begin work on the project in lieu of the DBE firm participation information listed in the executed contract. Unless MoDOT's written consent is provided as outlined above, the bidder shall not be entitled to any payment of work or material unless it is performed or supplied by the listed DBE.

(1) The bidder further certifies understanding, that if a DBE firm listed in the bid or approved in the executed contract documents ceases to be a certified DBE firm, at any time during the performance of the contract work, and a contract or subcontract with that firm has not yet been executed by the prime and subcontractor, the contractor cannot count any work performed by that firm after the date of the firm's loss of eligibility toward meeting the DBE contract goal. The contractor can pursue efforts to replace the work planned with the decertified firm, with other certified DBEs, in coordination with MoDOT's Business Development and Compliance Division. If the contractor has executed a subcontract with the firm before the DBE lost eligibility and ceased to be a certified DBE, the contractor may continue to receive credit toward the DBE contract goal for that firm's work on the executed subcontract. However, if the reason for the firm's DBE decertification is due to the firm being acquired or merged with a non-DBE, the portion of the work remaining after the date of decertification is not eligible for counting towards the contract goal. In this case, the Contractor must seek additional DBE participation to the extent needed to meet the contract goal or demonstrate that it has made good faith efforts to do so. Subcontract extensions that add work for firms that become decertified from the DBE program may not count for DBE goal credit without MoDOT's prior written consent.

(2) The bidder further certifies the bidder's understanding, that the dollar value of any work completed by a DBE firm prior to approval of the DBE's substitution or replacement, in writing, by MoDOT may not be credited toward meeting the DBE contract goal. No credit toward the DBE goal will be given for any amount withheld from payment to the DBE or "back charged" against monies owed to the DBE, regardless of the purpose or asserted debt.

10.0 DBE Participation for Contract Goal Credit. Goal credit will be in accordance with 49 CFR Part 26.55 as outlined for the following DBE Types:

- Subcontractor
- Manufacturer
- Regular Dealer
- Distributor
- Broker
- Trucker

11.0 Contract Goal Submittal. The bidder may submit the completed "DBE Identification Submittal" information in the bid documents at the same time as, and within the sealed bid, at the time the bid is submitted. However, if that information is not completed and submitted with the initial sealed bid, then as a matter of responsiveness and responsibility, all bidders shall file the completed "DBE Identification Submittal" pages with MoDOT on or before 4:00 p.m. of the third business day after the bid opening date, directly to the Business Development and Compliance Division, Missouri Department of Transportation, 105 W. Capitol

Avenue, P.O. Box 270, Jefferson City, Missouri 65102-0270. Submission via email and telefax transmittal to MoDOT will be permitted.

Fax no. (573) 526-0558

Email: DBE@MoDOT.Mo.Gov

Any “DBE Identification Submittal” that identifies a DBE regular dealer or distributor must be accompanied by a “DBE Regular Dealer/Distributor Affirmation Form” that is completed and signed by both the bidder and the DBE. This form must be received on or before 4:00 p.m. of the third business day after the bid opening date.

No extension of time will be allowed for any reason. The means of transmittal and the risk of timely receipt of the information shall be the bidder’s.

11.1 Good Faith Effort Submittal. If the bidder is not able to meet the Commission’s DBE contract goal, the bidder has the opportunity to submit with and as a part of the bid, a true, accurate, complete and detailed written explanation of good faith efforts taken to meet the DBE Contract Goal established in the bid documents. The bidder shall use the “DBE Identification Submittal” sheets for any DBE participation that will be committed towards the goal and an explanation, with any supporting documentation, for the inability to meet the full goal established on the contract. Any Good Faith efforts shall be submitted as part of the bid or within the three business days after the bid opening.

11.2 Bidders Good Faith Efforts Described. MoDOT will consider the quality, quantity, and intensity of the different kinds of efforts that the bidder has made based upon 49 CFR Appendix A to Part 26 and the following additional efforts:

- (a) Providing documentation on any and all past GFE activities for review.
- (b) Past project DBE performance utilization.
- (c) Race neutral methods utilized on completed projects.

All good faith efforts are evaluated on a case-by-case basis whereas any of the numerous good faith elements listed individually or collectively is not a guarantee of approval.

11.3 Administrative Reconsideration of the Bidder's Good Faith Efforts Made as a Part of the Bid Submittal. If MoDOT determines that the apparent low bidder has failed to adequately document in the bid that the bidder made a good faith effort to achieve sufficient DBE participation in the contract work, that firm will be offered the opportunity for administrative reconsideration upon written request, before MoDOT and the Commission reject that bid as non-responsive.

11.4 Forfeiture of Bid Bond possible when: The failure of the apparent low bidder to file the completed and executed “DBE Identification Submittal”, listing actual, committed DBE participation equal to or greater than the DBE contract goal percentage specified in the bid, or complete good faith effort participation by 4:00 p.m. on the third business day after the bid opening, will be cause for rejection of that bid. In addition, the bid surety bond or bid guaranty of the apparent low bidder will be forfeited to and become the property of the Commission upon Commission demand, only if the contract is awarded.

- (a) By submitting a bid on a federal-aid project, the bidder accepts and agrees to these provisions, and the disposition of the bidders bid bond or guaranty, upon demand by the Commission.

12.0 DBE Required to Perform a Commercially Useful Function (CUF). The DBE CUF requirements are stated in 49 CFR Part 26, (26.55). Any questions or further information needed for CUF determinations should be directed to MoDOT’s Business Development and Compliance Division.

12.1 Quality Control (QC) and Quality Assurance (QA) Reviews. The prime contractor shall monitor their planned DBE project usage for CUF compliance and provide MoDOT information for areas of concern for further evaluation. MoDOT will perform a QA review, or compliance review, for DBE CUF and project documentation retained by the contractor through project completion. The contractor shall maintain all DBE related information it has received, documented, and provided to MoDOT for a period of three years beyond the date of final inspection. MoDOT’s determination that a DBE’s participation may not count toward the project goal, or good faith effort level approved will be subject to administrative reconsideration.

12.2 MoDOT Makes Final Determination on Whether a CUF Is Performed. MoDOT will have the final authority to determine whether a DBE firm has performed a CUF on a federal-aid contract.

13.0 Verification of DBE Participation. (Assessment of Liquidated Damages Possible)

13.1 Final Payment from the Commission. Prior to final payment by the Commission, the contractor shall file with the Commission a detailed list showing each DBE used on the contract work, and the work performed by each DBE (Section 105.15.2.1). The list shall show the actual dollar amount paid to each DBE for the creditable work on the contract, less any rebates,

kickbacks, deductions, withholdings or other repayments made. The list shall be certified under penalty of perjury, or other law, to be accurate and complete. MoDOT and the Commission will use this certification and other information available to determine if the contractor and the contractor's DBEs satisfied the DBE contract goal percentage specified in the contract and the extent to which the DBEs were fully paid for that work. The contractor shall acknowledge, by the act of filing the detailed list, that the information is supplied to obtain payment regarding a federal participation contract.

13.2 Failure on the part of the contractor to achieve the DBE participation to which the contractor committed in the contract may result in liquidated damages being imposed on the contractor by the Commission for breach of contract and for non-compliance. If the contract was awarded with less than the original DBE contract goal proposed by the Commission, the revised lower amount became the final DBE contract goal, and that goal will be used to determine any liquidated damages to be assessed. Additionally, the Commission or MoDOT may impose any other administrative sanctions or remedies available at law or provided by the contract in the event of breach by the contractor by failing to satisfy the contractor's DBE contract goal commitment. The contractor will be offered the opportunity for administrative reconsideration of any assessment of liquidated damages determined at the project completion, upon written request. The administrative reconsideration officer may consider all facts presented, including the legitimacy or business reason for back charges assessed against a DBE firm, in determining the final amount of liquidated damages.

14.0 Miscellaneous DBE Program Requirements. In accordance with Title 49 CFR Part 26 and the Commission's DBE Program rules in Title 7 CSR Division 10, Chapter 8, the contractor, for both the contractor and for the contractor's subcontractors and suppliers, whether DBE firms or not, shall commit to comply fully with the auditing, record keeping, confidentiality, cooperation and anti-intimidation or retaliation provisions contained in those federal and state DBE Program regulations. By bidding on a federal-aid contract, and by accepting and executing that contract, the contractor agrees to assume these contractual obligations, and to bind the contractor's subcontractors contractually, at the contractor's expense.

15.0 Bidders List Data Collection. MoDOT is a recipient of federal funds and is required by 49 CFR 26.11, to provide data about its DBE program. To be considered responsive, all bidders must submit bidders list data with their bid. The information shall consist of the names of all DBE and non-DBE subcontractors, suppliers, manufacturers, distributors, or brokers for actual use and of consideration by the prime bidder. Submission of all other information outlined in 49 CFR 26.11(c)(2)(ii-vii) is at MoDOT's discretion. Electronic submittals and forms are provided to bidders that specify all required data points.

TRAINING PROVISION

04/22; 07/25

1.0 Description. This provision supplements subparagraph 7e of the Contract Provision entitled, "Standard Federal Equal Opportunity Construction Contract Specification", and in the implementation of CFR Part 230, Subpart A, Appendix B.

2.0 Purpose. It is the policy of MoDOT to require full utilization of all available training and skill-improvement opportunities to assure the increased participation of minority groups, disadvantaged persons and women in all phases of the highway construction industry. The intent of the On-the-Job Training Program is to recruit entry-level individuals, when feasible, and provide them with meaningful training intended to lead to journey-level employment. MoDOT and its sub-recipients, in carrying out the responsibilities of a federally assisted contract, shall determine which federal-aid construction contract shall include "Training Special Provisions." Under the Training Special Provisions, the Contractor shall make every reasonable effort to enroll minority, disadvantaged persons and women trainees to the extent such persons are available within a reasonable recruitment area. This training provision is not intended and shall not be used to discriminate against any applicant for training.

2.1 The Contractor is hereby advised that it is no excuse for a union, with which the Contractor has a collective bargaining agreement providing for exclusive referral, to fail to refer minority and female employees (23 CFR 230.411(e)(1)). Contractors are hereby made aware that if union referral practices prevent the contractor from meeting the EEO requirements, the contractor should make written notification to MoDOT's Business Development and Compliance Division (BDC) immediately. Furthermore, the FHWA's Form FHWA-1273 EO bid conditions are to be included in the Contractor's affirmative action plan (AAP). The EEO bid conditions specifically state, "In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the Contractor will, through independent recruitment efforts, fill the employment vacancies. Unions are not allowed to discriminate based on race, color, national origin or sex, union membership or non-membership, or domicile.

2.2 Contractors can sometimes demonstrate that they referred minorities and women to the unions for referral back to them, or the Contractors can demonstrate efforts made to request minorities and women from the union when they see their work force is deficient in certain construction trades. These efforts should be documented and will be verified by MoDOT.

3.0 Program Administration. All training goals, including the number of training hours, on federally funded projects are to be established by the Business Development and Compliance Division with Federal Highway Administration (FHWA) oversight. The following guidelines will be utilized in selecting projects and determining the goal to be set:

- a. Availability of minorities and women for training.
- b. The potential for effective training.
- c. Duration of the contract (number of working days).
- d. Dollar value of the contract.
- e. Total normal work force that the average bidder could be expected to use.
- f. Geographical location.
- g. Type of work.
- h. The need for additional journeymen in the area.
- i. The need to correct underutilization of minorities and females in specific trades.
- j. A satisfactory ratio of trainees to journeymen expected to be on the contractor's workforce during normal operations (considered to fall between 1:10 and 1:4).
- k. Recognition of the suggested minimum goal for the State.

3.1 Trainee goals will be set in 1,000 increments or 1 slot (person) per 1,000 hours per project. For example, if the trainee goal on the project is 2,000 hours a maximum of 2 trainees will be approved for the project. In the event a trainee leaves the project for valid reasons the trainee shall be replaced as soon as possible. **No apprentice/trainee can be assigned less than 500 hours on a contract.** MoDOT will not assign training on contracts that will not support the 500 hours. **Providing less than 500 hours is not considered to be beneficial training nor helping to achieve journey-level status. Therefore, a trainee/apprentice, regardless of craft, must have been trained on the contract for at least 500 hours to be eligible for reimbursement.** Upon reaching the 500 hours, the contractor will be compensated as noted herein. FHWA and MoDOT will only approve training programs meeting the requirements of the Training Special Provisions (TSP). A program will be approved if it is reasonably calculated to meet the equal employment opportunity obligations of the Contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved but not necessarily sponsored by the Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training will also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts.

3.2 No individual shall be employed as a trainee in any classification in which they have successfully completed a training course leading to journeyman status or in which the individual has been employed as a journeyman. The Contractor shall satisfy this requirement by including appropriate questions in the employee application or by other suitable means. It is the Contractor's responsibility to verify that the individual has not been trained or worked at the journey level and their records shall document the findings. Training under the TSP should only be directed toward those trades where underutilization/under representation exists. Flagging/traffic control programs are not considered as meeting the intent of the TSP. However, other programs that including flagging training will be approved if the flagging portion is limited.

3.3 The OJT Program is only intended to be utilized if the contractor is failing to attain the affirmative action goals in its contract, which are determined by the county the project is located. The affirmative action goals are broken down by minority and female goals. If the contractor is meeting or exceeding the minority and female goals in all crafts being utilized on the project, then the OJT requirements are not applicable. If the contractor is not obtaining the minority and female goals in each craft, then the OJT goal will be depended upon the actual participation achieved and the authentic contract as outlined in the contract.

4.0 Approval Process. Any trainee submitted to fulfill the OJT requirement must be in a registered training program. Acceptable training programs include:

- a. BAT Programs – Apprenticeship programs approved by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- b. Any other program, such as the Missouri Manpower Programs, which have been approved by FHWA and MoDOT on an annual basis.

4.1 Submittal of the TRAINEE NOTIFICATION – After the training plan has been approved, the Trainee Notification Form should be submitted within 30 days of the trainee commencing work on the project. It is the intention of these provisions that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower-level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification will be permitted only with the approval of the Business Development and Compliance Division. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training. Reimbursement to the Contractor for off-site training as indicated above may only be made when the Contractor does one or more of the following and the trainees are concurrently employed on federal-aid projects:

- Contributes to the cost of the training.

Provides the instruction to the trainee.
Pays the trainee's wages during the off-site training period.

5.0 Good Faith Efforts (GFE). Substantial Compliance – Although the OJT Program is specifically designed to increase minority and female participation on federal aid highway construction projects where underutilization exists, it is not intended to be discriminatory. Contractors and subcontractors may utilize a non-minority male apprentice/trainee if sufficient documented good faith efforts are taken to fill the specific training position with either minorities or females. The Contractor shall enroll minorities, women or economically disadvantaged individuals, where possible, and document their good faith efforts, prior to the hiring of non-minority males not identified as economically disadvantaged. The Contractor may suggest that a subcontractor fulfill a portion of the contract work. However, he/she shall determine how many, if any, of the trainees are to be trained by the subcontractor, and secure approval from MoDOT. Nevertheless, the Contractor shall retain the primary responsibility for meeting the training requirements imposed by this Special Provision. The Contractor shall apply the requirements of this Training Special Provision to such subcontracts. Where feasible, 25% of apprentice or trainees in each craft shall be in their first year of apprenticeship training. The Contractor shall be aware that even if a trainee has been previously approved to work on a prior MoDOT project, that trainee may not be approved on future projects if the trainee is not in their first year of apprenticeship training.

5.1 A good faith effort requires that the Contractor furnish evidence of their systematic and direct recruitment efforts through the use of public and private sources likely to yield minorities and females. The following example represents one element of good faith efforts: The Contractor must submit letters that are project specific (project location, how long it will last, type of pay) and targeted for the crafts utilized and must be sent to Community Based Organizations (CBOs) (two or three that are likely to refer minorities or females), and unions/apprenticeships (if union shop). The letters must be forwarded prior to job startup to alert CBOs to the possibility of the Contractor needing assistance finding minorities and females. These letters should be ongoing and targeted when the Contractor needs assistance in locating minorities and/or females in a specific craft. The Contractor's letters should also address anything the Contractor has done to hire minorities and/or females as well as files including employee referrals. The Contractor in his or her letter must request a response and the Contractor must note the results of the Contractor's request for assistance. Good faith efforts must be two-way communications with documented results. If a union contractor, contact the union first, then any and all other resources to include two or three CBOs.

5.2 The Contractor shall, upon request, be able to provide documentation of written solicitations to the unions, local or regional community action agencies, or other sources likely to refer minorities or women. Such efforts may be considered good-faith efforts if they were results oriented. If the Contractor's efforts are repetitive mechanical exercises that have never produced a referral or are "stuffing" - that is copies of letters not sent, then the non-productive activity cannot be considered to have been made in good faith. If, however, the Contractor can demonstrate that it employed referrals from the sources contacted on prior occasions and some efforts were not productive due to the lack of availability from usually dependable and responsive sources, then the non-productive effort can be considered good faith. In the absence of reasonable representation in any craft, the Contractor should be able to provide proof of its having requested referrals of minorities and women (i.e., records of telephone requests, including dates and times, persons talked with, and for which crafts minorities and women were requested). Letters should be detailed and include the type of vacancy to be filled, location of the project, potential employment opportunities with the company, and current as it relates to the specific job opportunity(ies).

5.3 All sources relied upon by the Contractor in advertising for vacancies and recruiting employees, especially those that resulted in referrals and employment should be identified and reported. Lists of minority organizations and other recruiting sources that have not been used or which have not been used recently or which if used have never referred anyone for employment should not be considered to meet the good faith effort test. All efforts reported by the Contractor to contact recruiting sources will be verified with the recruiting source listed. Contractors often send these recruiting sources "form" letters indicating they are under contract for a federal project. To be considered valid, recruitment letters should be specific. For example, recruitment letters should specify the positions for which referrals are sought, the number of employees needed, position requirements, estimated dates, who to contact, wage/salary range, and other information sufficient to elicit interest and references of potential employees. Form letters without specific information will not be considered good-faith efforts.

5.4 The terms and conditions of employment practiced by the Contractor should be explored to allow the Contractor the opportunity to demonstrate whether there is adequate representation of minorities and women throughout the life of the contract.

5.5 While it is the Contractor's prerogative to select who will be hired, recalled, rehired, or name requested, it is also the Contractor's responsibility to ensure equal employment opportunity for minorities and women.

5.6 The hours of minority and female employment and training should be substantially uniform throughout the length of the contract, and in each trade, and the Contractor is required to make a good faith effort to employ minorities and women evenly on each project when there are opportunities to do so. The Contractor should not wait to hire minorities and women at the "eleventh hour" or "bicycle" employees from project to project.

5.7 In the event the Business Development and Compliance Division denies the Good Faith Effort (GFE) submitted by the contractor, the contractor shall have the right to an Administrative Reconsideration Hearing. The request for an administrative reconsideration hearing must be made within seven (7) days of the receipt of the denial letter. The Administrative Reconsideration Committee may be constituted, as MoDOT deems appropriate and fair, provided that no committee member on the Reconsideration Committee shall have taken part in the original MoDOT determination that the contractor failed to meet the OJT contract goal and/or failed to make adequate good faith efforts to do so.

5.8 If the Administrative Reconsideration Committee does not find the contractor met the OJT contract goal, and/or does not find that the contractor made adequate and sufficient good faith efforts to do so, then The Administrative Reconsideration Committee will recommend that liquidated damages as outlined in the non-compliance sanctions section below be carried out. If the Administrative Reconsideration Committee does find that the contractor has met a good faith effort (GFE), then no liquidated damages will be assessed.

6.0 Economically Disadvantaged Verification. When a contractor submits a trainee who is economically disadvantaged the following information should be submitted with the trainee notification to verify this status:

The previous year's tax return verifying the individual's income is less than the federal poverty guidelines, or
Verification of enrollment in any government issued entitlement programs.

7.0 Beneficial Training. MoDOT will ensure its contractors provide on-the-job training aimed at developing or contributing to full journey level status in the type of trade(s) involved. Training shall be consistent with the trainee/apprentice program. Training tasks will be consistent with the approved trade classification for the specific contract. The Contractor shall furnish the trainee a copy of the program the Contractor will follow in providing the training. The Contractor shall provide each trainee and Resident Engineer documentation showing the type and length of training that will be completed include classroom and on-the-job hours. This includes providing information on the monthly trainee report and trainee notification as to the total working and classroom hours the trainee/apprentice has completed to date.

8.0 Training Reimbursement Process. Except as otherwise noted herein, the Contractor will be reimbursed \$10.00 per hour of training given an employee on this contract in accordance with an approved training program.

8.1 Reimbursement will be made at the end of the project, once all trainee hours have been submitted, as well as the trainee summary. The Contractor will be reimbursed for hours each trainee has attained on the project, with the minimum hours for reimbursement eligibility being 500. Contractors will be reimbursed in instances where the OJT goal is met as well as if a Good Faith Effort is made to meet the goal. Reimbursement will not be made if the OJT goal was not met, and the contractor did not make a Good Faith Effort to meet the goal.

8.2 Training will not be reimbursed if the Contractor fails to provide beneficial training. This includes only partially meeting the training goal on the project.

8.3 A request may be submitted to the Business Development and Compliance Division to increase the Training Hours assigned to a contract. Approval of such requests by the Business Development and Compliance Division will be granted on a case-by-case basis.

8.4 The Contractor is eligible to be reimbursed the total OJT hours assigned to the project once those hours have been fulfilled. For any hours achieved beyond the goal, the contractor must request this additional reimbursement from the BDC Division, and, with concurrence from the Resident Engineer, the contractor is then eligible to receive reimbursement of hours achieved beyond the goal, either 25% of hours over the goal or 500, whichever is less. Outlined below is the maximum overrun reimbursements:

<u>OJT Goal</u>	<u>Hours Achieved</u>	<u>Payable Hours</u>
1,000	1,250	1,250
2,000	1,500	1,500
3,000+	1,501+	1,500

9.0 Monitoring. MoDOT will monitor contractors to ensure trainees and apprentices are receiving beneficial training in the type of trades submitted. Training shall be consistent with the training program or those OJT Programs the FHWA and MoDOT have approved.

9.1 It is normally expected that the trainee/apprentice will begin training on the project as soon as possible, utilizing the skills involved and remaining on the project as long as training opportunities exist in the work classifications or until the completion of the training program.

9.2 Project Office staff will periodically interview trainees to determine:

Whether apprentice/trainee is receiving training in designated craft
 Workplace environment
 If trainee/apprentice is experiencing problems on the job site
 If the apprentice/trainee is being treated fairly

9.3 MoDOT monitors contracts with training through onsite visits, monthly training reports and construction reports. These reports are generated by the Contractor and are to be disseminated to the Project Office. If there are problems, the Business Development and Compliance Division will contact the Contractor to address the deficiencies.

9.4 Trainees will be paid at the rate set by the training program. The appropriate minimum journeyman's rate paid cannot be less than the amounts set out in the 23 CFR Subpart A, Appendix B. For example, at least 60 percent of the appropriate minimum journey person's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period and 90 percent for the last quarter of the training period. The appropriate rates approved by the Department of Labor or Transportation in connection with the existing programs shall apply to all apprentice or trainees being trained for the same classification who are covered by the Training Special Provision.

10.0 Reports. The Contractor shall provide for the maintenance of records and furnish monthly reports documenting the Contractor's performance under this provision. All trainee notifications must be submitted within 30 days of the trainee's start date. If a trainee has been previously approved by MoDOT, the Contractor must still notify MoDOT of the name of the individual(s) and proposed craft the trainees will be trained in, as well as indicate which project the trainees will be working on. The trainee notifications or listing of the proposed trainees must be submitted via fax, mail or electronically to the BDC Division. If the Contractor fails to submit the trainee notification or list of proposed trainees prior to the onset of the project, the Contractor will be subject to the sanctions as outlined in this OJT TSP. All sections in the monthly reports shall be completed and the report submitted to the project office by the 15th of the following month.

11.0 Non-Compliance Sanctions. Progress payments shall be withheld for failing to comply with all OJT Program requirements unless MoDOT accepts Good Faith Efforts.

11.1 If the training hours have not been obtained and a GFE has not been displayed upon project completion, the Contractor will be assessed liquidated damages in the amount of \$20.00 per hour for those hours not realized. For instance, if the project goal was 1,000 hours and only 450 hours were met, then liquidated damages would be assessed at $550 \times \$20.00 = \$11,000.00$.

11.2 If the Business Development and Compliance Division approves a GFE, then liquidated damages will not be assessed. An approved GFE along with the minimum 500 training hours will result in reimbursement for the applicable hours.

11.3 If the Contractor does not achieve the full OJT goal, they will not receive partial credit for hours completed under 500 per trainee. For instance, if the goal on the project was 1,000 hours and only 450 were convened, then no reimbursement will be given for any hours fulfilled. If the goal on the project is 2,000 hours and only 1,500 hours are completed and no GFE is demonstrated, the contractor will receive credit for the 1,500 hours and also be assessed liquidated damages in the amount of the 500 hours that there were not met.

11.4 In the event the Contract exceeds the trainee goal on the project, the Contractor must submit a request to BDC to obtain an extension of hours. The maximum number of hours beyond those enumerated in the contract cannot exceed 25% per 1,000 hours, with a maximum of 500 hours eligible for reimbursement beyond the goal. This extension is subject to the **advance** approval of the BDC Division, and concurrence from the Resident Engineer.

11.5 Trainee reports must be submitted following the last pay period of the month, no later than the 15th of the following month. Failure to timely submit the reports, hours completed during that month could result in hours not being credited. In the cases of voluntary or involuntary trainee termination or when the trainee completes the hours specified in the program, the contractor must complete the trainee completion form within 30 days. The Contractor's failure to submit the proper reports in a timely manner may result in the loss of reimbursement for the training hours for that month

11.6 Failure to satisfactorily comply with the OJT requirements will also be reflected in the contractor's performance evaluation.

OPTIONAL ROLLER COMPACTED CONCRETE SHOULDERS AND MAINLINE

01/16; 04/22

1.0 Description. Roller Compacted Concrete (RCC) is an optional method to be used in constructing A2 and A3 shoulders or mainline pavement up to 7 inches thick in lieu of conventional PCCP or HMA placement. RCC may be used, as designed in the plans, for mainline pavements greater than 7 inches. RCC consists of aggregate, portland cement and water. Supplementary

cementing materials, such as fly ash, slag cement (ground granulated blast- furnace slag - GGBFS), and silica fume may be used. RCC is proportioned, mixed, placed, compacted, and cured in accordance with these specifications. RCC shall conform to the lines, grades, thickness, and typical cross section shown in the plans or otherwise established by the Engineer.

2.0 Materials. All materials shall be in accordance with Division 1000, Materials Details, and specifically as follows:

Item	Section
Coarse Aggregate	1005.2
Fine Aggregate	1005.3
Ground Granulated Blast Furnace Slag	1017
Fly Ash	1018
Cement	1019
Concrete Admixture	1054
Curing Compound	407, 1055
Water	1070

2.1 Aggregate. The plasticity index of the aggregates used shall not exceed 5. The aggregate gradation shall be well-graded without gradation gaps and shall meet the following combined gradation for the application type for RCC specified in the contract:

Application	RCC as a Base or Intermediate Lift (Overlaid with 2-inch HMA or greater)	RCC as the Final Surface or with a Thin Lift Overlay (RCC as the final surface or capped with a thin HMA overlay less than 2-inches)
Sieve Size	Percent Passing by Weight	Percent Passing by Weight
1 inch	100	---
¾ inch	---	100
½ inch	70 - 95	85 - 100
3/8 inch	60 - 85	---
No. 4	40 - 60	60 - 85
No. 8	--	40 - 60
No. 200	0 - 8	0 - 10

3.0 Mix Design. At least 30 days prior to the beginning of placing RCC on the project, the Contractor shall submit a proposed mix design to the Engineer. The target and allowable gradation range of each fraction shall be included. The contractor may be required to submit representative samples of each ingredient to Construction and Materials for laboratory testing.

3.1 Required Information. The mix design shall contain the following information:

- (a) Source, type and specific gravity of portland cement
 - (b) Source, type (class, grade, etc.) and specific gravity of supplementary materials, if used
 - (c) Source, name, type and amount of admixture, if used
 - (d) Source, type (formation, etc.), ledge number if applicable, of the aggregate
 - (e) Specific gravity and absorption of each fraction in accordance with AASHTO T 85 for coarse aggregate and AASHTO T 84 for fine aggregate, including raw data
 - (f) Unit weight of each fraction in accordance with AASHTO T 19
 - (g) Batch weights of portland cement and supplemental cementitious materials
 - (h) Batch weights of coarse, intermediate and fine aggregates
 - (i) Batch weight of water in pounds per cubic yard (optimum moisture content)
 - (j) Maximum laboratory density
 - (k) The laboratory proctor curves illustrating moisture contents vs. density for each cementitious material content.
- The RCC mix design shall be done in a similar fashion as is done to determine the relationship between the moisture content and

the unit weight as soils and soil aggregate mixtures. The apparatus and compacted effort used to fabricate the moisture density specimens correspond to that described in AASHTO T 180, Method D. Strength specimens shall be made in accordance with ASTM C 1176 or ASTM C 1435 at the optimum moisture content for each cementitious material content to verify minimum compressive strength requirements.

3.2 Trial Batch. The Contractor shall prepare and test a trial batch mixture at the mixing facility to verify that the RCC mix complies with the design criteria. The trial batch shall be prepared and tested in the presence of the Engineer.

3.3 Production. Production shall not begin until an approved mix design has been obtained and verified by the trial batch.

3.4 Design Strength. The mix design shall have a minimum compressive strength of 3,500 psi within 28 days when specimens prepared according to ASTM C 1176 or ASTM C 1435. Compressive strength test shall be performed in accordance with AASHTO T 22.

3.5 Minimum Water Content. The water-cement ratio shall not be lower than 0.25.

3.6 Minimum Cementitious Content. The total amount of cementitious materials shall not be below 450 pounds per cubic yard.

3.7 Supplementary Cementitious Material. RCC may use fly ash, slag cement (GGBFS), or silica fume. Ternary mixes will be allowed for RCC. Ternary mixes are mixes that contain a combination of portland cement and two supplementary cementitious materials. The amount of supplementary cementitious material content shall be limited to the following requirements:

Supplementary Cementitious Material (SCM)	
SCM	Maximum Percent of Total Cementitious Material
Fly Ash (Class C or Class F)	25 %
Slag Cement (GGBFS)	30 %
Silica Fume	8 %
Ternary Combinations	40 %

4.0 Equipment. RCC shall be constructed with any combination of equipment that will produce a pavement meeting the requirements for mixing, transporting, placing, compacting, finishing, and curing as provided in this specification.

4.1 Mixing Plant: The mixing plant shall be capable of producing RCC to the proportions defined by the final approved mix design and within the specified tolerances. The capacity of the plant shall be sufficient to produce a uniform mixture at a rate compatible with the placement equipment.

4.2 Paver: RCC shall be placed with a high-density or conventional asphalt type paver subject to approval by the Engineer. The paver shall be of suitable weight and stability to spread and finish the RCC material, without segregation, to the required thickness, smoothness, surface texture, cross-section, and grade.

4.3 Compactors: When a conventional asphalt type paver is used, self-propelled steel drum vibratory rollers shall be used for primary compaction. For final compaction, a steel drum roller, operated in a static mode, or a rubber-tired roller may be utilized to meet density requirements.

4.4 Haul Equipment: The hauling equipment shall be smooth, mortar-tight, metal containers capable of discharging the concrete at a controlled rate without segregation. Hauling equipment shall have a retractable cover to protect mix from weather and excessive evaporation.

4.5 Access for Inspection and Calibration: The Engineer shall have access at all times for any plant, equipment, or machinery to be used in order to check calibration, scales, controls, or operating adjustments.

5.0 Construction Requirements.

5.1 Preparation of Subgrade. Before the RCC processing begins, the subgrade and base course must be prepared in accordance with Sec 304.

5.2 Subbase Condition. The surface of the subbase shall be clean and free of foreign material and standing water prior to placement of the RCC. The aggregate base shall be uniformly moist at the time of RCC placement. RCC shall not be placed upon frozen subbase.

5.3 Mixing Time. Mixing time shall be adequate to ensure a thorough and complete mixing of all materials. Concrete shall be homogeneous with no aggregate segregation. In no case shall the mixing time, after all materials including water are in the mixer, be less than 90 seconds.

5.4 Operating Tolerances. The mixing plant shall receive the quantities of individual ingredients to within the following tolerances:

Material	Variation by Weight
Cementitious Materials	± 2.0%
Water	± 3.0%
Aggregates	± 4.0%

5.5 Plant Calibration. Prior to RCC production, the Contractor shall calibrate the plant in accordance with the manufacturer's recommended practice. A copy of the calibration shall be provided to the Engineer when requested.

5.6 Curing. Immediately after final rolling, the RCC surface shall be kept continuously moist until an approved curing compound is applied. The application of the curing compound shall progress such that no more than 10 linear feet of the final RCC surface is exposed without curing at any time.

5.6.1. Water Cure. Water cure shall be applied such that a uniform moist condition on the surface of the RCC is attained. Application of this moisture shall be done in a manner that will not erode or damage the finished RCC surface.

5.6.2 Curing Compound. When RCC is used as the final surface, either white pigmented curing compound applied at the rate of one gallon for each 100 square feet or a tack coat product applied at 0.14 gal/yd² shall be used for curing. When RCC is to be overlaid with asphalt, the curing compound shall be a tack coat product applied at 0.14 gal/yd² in accordance with Sec 407.

5.7 Weather Conditions.

5.7.1 Hot Weather Precautions. During periods of hot weather or windy conditions, special precautions shall be taken to minimize moisture loss due to evaporation.

5.7.2 Cold Weather. The contractor shall provide a method, meeting the approval of the engineer, of monitoring the concrete that demonstrates that the concrete has been protected from freezing.

5.7.3 Protection Against Rain. To protect against rain, the contractor shall have on location at all times material for the protection of the unhardened concrete. The contractor shall protect the concrete from damage due to rain.

5.8 Finished Surface. The finished RCC surface shall be smooth, uniform, and continuous without tears, ridges, or aggregate segregation once it leaves the paver. RCC mainline pavement shall meet the smoothness criteria of [Sec 502.8](#). When RCC is the final surface, the finished surface texture shall be broom finished, diamond ground, or other finishes approved by the engineer. All finished surface textures shall be in accordance with Sec 502.4.

5.8.1 Inaccessible Areas. All areas inaccessible to either roller or paver shall be paved with cast-in-place concrete in accordance with Sec 502.

5.8.2 Handwork. Broadcasting or fanning the RCC material across areas being compacted is not permissible. Such additions of materials may only be done immediately behind the paver and before any compaction has taken place.

5.8.3 Segregation. If segregation occurs in the RCC during paving operations, placement shall cease until corrective measures are taken.

5.9 Cold Joints. Prior to placing fresh RCC mixture against a cold vertical joint, the joint shall be thoroughly cleaned of loose or foreign material. The vertical joint face shall be wetted and in a moist condition immediately prior to placement of the adjacent lane.

5.10 Control Joints. Concrete control joints shall be constructed at 15-foot intervals in RCC mainline pavement. Control joint spacing for RCC shoulders adjacent to HMA or composite pavement shall be a minimum of 30-foot intervals. RCC shoulders adjacent to existing PCC pavement shall have control joints located to match the joints of the adjacent pavement. For all other PCC joint spacing; the RCC control joints shall match the adjacent PCC pavement's joints or cracks not to exceed a 30-foot interval. All control joints shall be tooled or cut to 1/3 the depth of the RCC thickness. Sealing the control joints is not required.

5.11 Opening to Traffic. The Contractor shall protect the RCC from traffic during the curing period. The RCC shoulder pavement may be opened to light traffic after one day and opened to unrestricted traffic after 5 days. The RCC mainline pavement may be opened to light traffic at 2,500 psi and opened to unrestricted traffic at 3,000 psi.

6.0 Material Acceptance.

6.1 Quality Control Testing. The contractor shall perform all quality control tests necessary to control the production and construction processes applicable to this specification. Quality control testing shall be performed by technicians qualified through MoDOT's technician certification program. Testing shall include, but not necessarily be limited to, deleterious content, aggregate gradation, coarse aggregate absorption, thin or elongated pieces, pavement thickness and density. The contractor shall record all test results and furnish a copy to the engineer no later than the beginning of the day following the test.

6.2 Quality Control Plan. A Quality Control Plan (QCP) for RCC mainline pavement and shoulders will be required as per [Sec 502.11.1](#).

6.3 Testing.

6.3.1 Density. The density shall be determined in accordance with AASHTO T 310, direct transmission. Tests shall be performed no later than 30 minutes after the completion of the rolling. Only wet density shall be used for evaluation. QC shall determine the density of the RCC shoulder and mainline pavement at a frequency of no less than one per 7500 square yards. Sampling locations will be determined by the engineer using random sampling procedures in accordance with ASTM D 3665.

6.3.2 Thickness. The contractor shall determine thickness of the RCC shoulder and mainline pavement by testing the fresh concrete. The Resident Engineer will need to review and approve the testing procedure. QC shall determine the thickness of the RCC mainline pavement and shoulders at a frequency of no less than one per 7,500 square yards. Sampling locations will be determined by the engineer using random sampling procedures in accordance with ASTM D 3665.

6.4 Aggregate Gradation. A sieve analysis shall be performed once a week. Testing shall be performed in accordance with AASHTO T 27 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

6.5 Deleterious Materials. Deleterious content shall be determined each day at a frequency of one test per 7500 square yards of material placed or fraction thereof. Test shall be performed in accordance with MoDOT TM 71 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt. Tests shall be performed on coarse aggregate fractions.

6.6 Absorption. Samples for coarse aggregate absorption shall be taken from the discharge gate of storage bins or from the conveyor belt at least once every 2000 cubic yards with a minimum of once per project. Coarse aggregate absorption shall be performed in accordance with AASHTO T 85.

6.7 Thin or Elongated. Thin or elongated pieces shall be determined on samples of coarse aggregate taken from the discharge gate of the storage bins or from the conveyor belt. Test shall be performed in accordance with ASTM D 4791 using a ratio of 5:1. Test shall be performed on aggregate particles retained on the $\frac{3}{4}$ in. sieve. Tests shall be performed at least once every 10,000 cubic yards with a minimum of once per project.

6.8 Retained Samples. All aggregate samples taken by the contractor, including but not limited to gradation, deleterious, absorption, and thin or elongated pieces shall be retained for the engineer for a minimum of seven days unless otherwise instructed. The retained sample shall be the remaining half of the final reduction in sample size obtained for QC testing. These samples shall be maintained in clean covered containers, without contamination, readily accessible to the engineer. The retained sample's identification shall consist of, but is not limited to:

- (a) Time and date sampled
- (b) Product specification number
- (c) Type of sample, i.e., belt, bin, stockpile
- (d) Lot and subplot designation
- (e) Sampler/Tester
- (f) Project Job Number

6.9 Acceptance.

6.9.1 Density. The density shall not be less than 98 percent of the maximum laboratory density.

6.9.1.1 Compressive Strength. Roller compacted concrete properly placed and compacted, but not meeting the density requirements shall be cored and tested for compressive strength at no additional cost. Cores shall be taken in accordance with AASHTO T 24. The compressive strength shall be determined by approved methods. Cores shall be tested for compressive strength within 7 days of density testing. If the tested area achieves the design strength, the material will be paid for at full price. Areas that fail to comply with the design strength will be deemed unacceptable and shall be addressed in accordance with Sec 105.11.

6.9.2 Thickness. The thickness shall not be deficient by more than 10 percent of the plan thickness. Areas that fail to comply with the design thickness will be deemed unacceptable and shall be addressed in accordance with Sec 105.11.

6.9.3 Aggregate Gradation. When one test is outside the allowable gradation range, immediate steps shall be taken to correct the gradation.

6.9.4 Deleterious Materials. When one test is outside the specification limits, immediate steps shall be taken to correct the deleterious content.

6.9.5 Absorption. The contractor shall halt production and make appropriate adjustments whenever either of the following occurs:

- (a) One point falls outside the action limit line for individual measurement
- (b) Two points in a row fall outside the specification limit but within the action limit line for individual measurement

6.9.5.1 Action Limits. The following action limit shall be used to control the aggregate absorption.

Individual Measurements	
Control Parameter	Action Limit
Absorption	Mix Design plus 0.3% to Mix Design plus 0.6%

6.9.6 Thin or Elongated Pieces. The coarse aggregate shall not have more than 5 percent thin or elongated pieces.

7.0 Quality Assurance.

7.1 Independent Samples. Corrective action shall be required when any QA tests are outside the required ranges or action limits. The engineer will at a minimum, independently test at the following frequency:

Test	Frequency
Density	1 test per 30,000 square yards
Thickness	1 test per 30,000 square yards
Aggregate Gradation	1 per project
Coarse Aggregate Deleterious	1 per week
Absorption	1 per 10,000 cubic yards
Thin or Elongated	1 per project

7.2 Test Procedures. The engineer will use the same test procedures as the contractor for determining the density and thickness of the RCC.

7.3 Retained Samples. The QA inspector will test at least ten percent of the retained portion of the QC samples for aggregate gradations and deleterious content. The QA inspector will test at least twenty percent of the QC retained samples for absorption and thin or elongated pieces. Retained samples will be chosen at random. A comparison will be considered favorable when the QA results of a QC retained sample are within the applicable limits specified in [Sec 403](#).

8.0 Method of Measurement. Final measurement of the completed pavement will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. Where required, measurement of the RCC

mainline pavement and shoulders, complete in place, will be made to the nearest 1/10 square yard. The revision or correction will be computed and added to or deducted from the contract quantity.

9.0 Basis of Payment. The accepted quantities of RCC will be paid for at the contract unit price, for specified A2 or A3 shoulders or mainline. Sec 610 for smoothness pay factor adjustments will apply to the final RCC mainline pavement surface. The contract unit price for A2 or A3 shoulders or mainline pavement will be considered as full compensation for all materials, equipment, tools, labor, and incidentals necessary to satisfactorily complete the work. No additional compensation will be allowed for any excess thickness.

GROUND TIRE RUBBER (GTR) DRY PROCESS MODIFICATION OF BITUMINOUS PAVEMENT MATERIAL

07/24

1.0 Description. This work shall consist of the dry process of adding ground tire rubber (GTR) to modify bituminous material to be used in highway construction. Existing GTR requirements in Section 1015 pertain to the wet process method of GTR modification that blends GTR with the asphalt binder (terminal blending or blending at HMA plant). The following requirements shall govern for dry process GTR modification. The dry process method adds GTR as a fine aggregate or mineral filler during mix production. All GTR modified asphalt mixtures shall be in accordance with Secs 401, 402, or 403 as specified in the contract; except as revised by this specification.

2.0 Materials. The contractor shall furnish a manufacturer's certification to the engineer for each shipment of GTR furnished stating the name of the manufacturer, the chemical composition, workability additives, and certifying that the GTR supplied is in accordance with this specification.

2.1 Product Approval. The GTR product shall contain a Trans-Polyoctenamer (TOR) added at 4.5 % of the weight of the crumb rubber or an engineered crumb rubber (ECR) workability additive that has proven performance in Missouri. Other GTR additives shall be demonstrated and proven prior to use such as a five-year field performance history in other states or performance on a federal or state-sanctioned accelerated loading facility.

2.2 General. GTR shall be produced from processing automobile or truck tires by ambient or cryogenic grinding methods. Heavy equipment tires, uncured or de-vulcanized rubber will not be permitted. GTR shall also meet the following material requirements:

Table 1 – GTR Material Properties		
Property	Test Method	Criteria
Specific Gravity	ASTM D1817	1.02 to 1.20
Metal Contaminates	ASTM D5603	≤ 0.01%
Fiber Content	ASTM D5603	≤ 0.5%
Moisture Content	ASTM D1509	≤ 1.0%*
Mineral Filler	AASHTO M17	≤ 4.0%

*Moisture content of the GTR shall not cause foaming when combined with asphalt binder and aggregate during mix production

2.3 Gradation. The GTR material prior to TOR or ECR workability additives shall meet the following gradation and shall be tested in accordance with ASTM D5603 and ASTM D5644.

Table 2 – GTR Gradation	
Sieve	Percent Passing by Weight
No. 20	100
No. 30	98-100
No. 40	50-70
No. 100	5-15

3.0 Delivery, Storage, and Handling. The GTR shall be supplied in moisture-proof packaging or other appropriate bulk containers. GTR shall be stored in a dry location protected from rain before use. Each bag or container shall be properly labeled with the manufacturer's designation for the GTR and specific type, mesh size, weight and manufacturer's batch or Lot designation.

4.0 Feeder System. Dry Process GTR shall be controlled with a feeder system using a proportioning device that is accurate to within ± 3 percent of the amount required. The system shall automatically adjust the feed rate to always maintain the material within this tolerance and shall have a convenient and accurate means of calibration. The system shall provide in-process monitoring, consisting of either a digital display of output or a printout of feed rate, in pounds per minute, to verify feed rate. The supply system shall report the feed in 1-pound increments using load cells that will enable the user to monitor the depletion of the GTR. Monitoring the system volumetrically will not be allowed. The feeder shall interlock with the aggregate weight system and asphalt binder pump to maintain correct mixture proportions at all production rates.

Flow indicators or sensing devices for the system shall be interlocked with the plant controls to interrupt mixture production if GTR introduction rate is not within ± 3 percent. This interlock will immediately notify the operator if GTR introduction rate exceeds introduction tolerances. All plant production will cease if the introduction rate is not brought back within tolerance after 30 seconds. When the interlock system interrupts production and the plant has to be restarted, upon restarting operations; the modifier system shall run until a uniform feed can be observed on the output display. All mix produced prior to obtaining a uniform feed shall be rejected.

4.1 Batch Plants. GTR shall be added to aggregate in the weigh hopper. Mixing times shall be increased per GTR manufacturer recommendations.

4.2 Drum Plants. The feeder system shall add GTR to aggregate and liquid binder during mixing and provide sufficient mixing time to produce a uniform mixture. The feeder system shall ensure GTR does not become entrained in the exhaust system of the drier or plant and is not exposed to the drier flame at any point after introduction.

5.0 Testing During Mixture Production. Testing of asphalt mixes containing GTR shall not begin until at least 30 minutes after production or per additive supplier's recommendation.

6.0 Construction Requirements. Mixes containing GTR shall have a target mixing temperature of 325 F or as directed by the GTR additive supplier. The additive supplier's recommendations shall be followed to allow for GTR binder absorption/reaction. This may include holding mix in the silo to allow time for binder to absorb into the GTR. Rolling operations may need to be modified.

7.0 Mix Design Test Method Modification. A formal mixing procedure from the additive supplier shall be provided to the contractor and engineer that details the proper sample preparation, including blending GTR with the binder or other additives. Samples shall be prepared and fabricated in accordance with this procedure by the engineer and contractor throughout the duration of the project.

8.0 Mix design Volumetrics. Mix design volumetric equations shall be modified as follows:

8.1 Additional virgin binder added to offset GTR absorption of binder shall be counted as part of the mix virgin binder

8.2 GTR shall be included as part of the aggregate when calculating VMA of the mix.

8.2.1 GTR SPG shall be 1.15

8.3 Mix G_{sb} used to determine VMA shall be calculated as follows:

$$G_{sb (JMF)} = \frac{(100 - P_{bmv})}{\left(\frac{P_s}{G_{sb}} + \frac{P_{GTR}}{G_{GTR}}\right)}$$

where:

$G_{sb (JMF)}$ = bulk specific gravity of the combined aggregate including GTR

P_{bmv} = percent virgin binder by total mixture weight

P_s = percent aggregate by total mixture weight (not including GTR)

P_{GTR} = percent GTR by total mixture weight

G_{sb} = bulk specific gravity of the combined aggregate (not including GTR)

G_{GTR} = GTR specific gravity

8.4 G_{se} shall be calculated as follows:

$$G_{se} = \frac{(100 - P_b - P_{GTR})}{\left(\frac{100}{G_{mm}} - \frac{P_b}{G_b} - \frac{P_{GTR}}{G_{GTR}}\right)}$$

8.5 P_{be} shall be calculated as follows:

$$P_{be} = P_b - \frac{P_{ba}}{100} * (P_s + P_{GTR})$$

9.0 Minimum GTR Amount. The minimum dosage rate for GTR shall be 5 % by weight of total binder for an acceptable one bump grade or 10 % by weight of total binder for an acceptable two bump grade as detailed in the following table. Varying percentage blends of GTR and approved additives may be used as approved by the engineer with proven performance and meeting the specified requirements of the contract grade.

Contract Binder Grade	Percent Effective Virgin Binder Replacement Limits	Required Virgin Binder Grade	Minimum GTR Dosage Rate
PG 76-22	0 - 20	PG 70-22	5 %
		PG 64-22	10 %
PG 70-22	0 - 30	PG 64-22	5 %
		PG 58-28	10 %
PG 64-22	0 - 40*	PG 58-28	5 %
		PG 52-34	10 %
PG 58-28	0 - 40*	PG 52-34	5 %
		PG 46-34	10 %

* Reclaimed Asphalt Shingles (RAS) may be used when the contract grade is PG 64-22 or PG 58-28. RAS replacement shall follow the 2 x RAS criteria when calculating percent effective binder replacement in accordance Sec 401.

SAFETY PLAN

04/16

1.0 Description. This contractor shall submit to the engineer a project Safety Plan (SP) for all work performed by the contractor and all subcontractors. The purpose of the SP is to encourage and enable all work to be performed in the safest possible manner and that all parties involved are aware of their individual responsibility for safety on the jobsite.

1.1 The SP shall be completed by the contractor and provided to the engineer prior to the beginning of any construction activity or phase on the project.

1.2 The contractor shall designate a person to serve as Project Safety Manager (PSM). The PSM shall be responsible for implementing and overseeing the SP. The PSM is not required to be present on the project at all times, but must be available to address safety issues and needs.

1.3 The PSM shall make revisions to the SP as necessary. Any new project activities or phases shall be included in the SP prior to work beginning on that activity or phase.

1.4 An example Safety Plan is available at: <https://www.modot.org/safety-plan>

2.0 Emergency Preparedness. The SP shall outline and detail for all workers, the specific procedures and actions necessary to respond to a jobsite emergency and the measures taken to communicate these requirements to all workers.

2.1 The SP shall include a list of local emergency contacts including phone numbers. A copy of the emergency contact list shall be accessible to workers.

2.2 In the case where there is no cellular or land line phone service at the jobsite, the SP shall identify how to reach the nearest available phone service.

3.0 Project Safety Analysis. The SP should contain a basic Project Safety Analysis (PSA) that outlines the actions necessary to complete each activity or phase of the project. The SP shall include a general description of the primary activities or steps required to safely complete the project.

3.1 Each activity should also include a general description of the work involved along with the known risks associated with the activity. In addition, the PSA should outline the controls for those risks, including any Personal Protection Equipment (PPE) requirements for that activity or phase, and whether or not the activity or phase requires a specific safety meeting prior to beginning the activity or phase.

3.2 Submittal of the PSA for all activities or phases is not required with the initial submittal of the SP; however, the PSA for each activity or phase shall be completed prior to the beginning of that activity or phase.

4.0 Safety Meetings. The SP shall include the types of safety meetings that will be required of and conducted by the contractor.

5.0 Safety Training. The SP shall identify the required safety training provided to the contractor's personnel. The contractor shall require that the appropriate safety training for the contractor's personnel is completed prior to the beginning of work on each activity or phase.

5.1 The SP shall identify the recommended safety training needs and PPE for MoDOT employees who will be exposed to the work activities. MoDOT will provide safety training and PPE to MoDOT employees based on MoDOT safety policies.

6.0 Payment. There will be no direct payment for compliance with this Safety Plan provision.

SAFETY EDGESM

04/16; 04/18

1.0 Description. An approved longitudinal shoulder wedge system shall be used to create a beveled edge at the edge of pavement for a roadway without a paved shoulder, or at the edge of shoulder for pavement with a paved shoulder up to and including 4 feet in width.

2.0 Construction Requirements. The Safety Edge shall be constructed as shown in Standard Plan 401.00. The construction tolerance of the 30 degree Safety EdgeSM shall be plus or minus 5 degrees.

2.1 The shoulder wedge system shall maintain contact between the device and road shoulder surface and allow automatic transition to cross roads, driveways and obstructions. The device must be removable or be able to be lifted when not in use.

2.2 All shoulder wedge systems to be used for the purpose of creating a Safety EdgeSM must be approved by the engineer. The device must be designed to constrain the material, increase the consolidation of the extruded profile, and provide a smooth wedged surface. The use of a conventional single plate strike-off is not permitted.

3.0 Basis of Payment. There will be no direct payment for compliance with the requirements of this provision.

E-CONSTRUCTION

01/17; 1/19; 04/22; 7/26

1.0 Description. E-Construction is a paperless construction administration delivery process that includes electronic submission of construction documents, approval of documents with digital signatures, and communication between stakeholders by mobile devices. E-Construction saves both time and money for all stakeholders involved, simplifies document storage, and eliminates waste of paper and other resources. This provision does not apply to the execution of the contract which is defined elsewhere in this contract.

2.0 Document Submittals.

2.1 The contractor shall submit all required documents to MoDOT electronically, except as described in Section 2.2 of this provision. Documents to be submitted electronically include, but are not limited to, Change Orders, Request to Subcontract Work (C-220), Project Payrolls, Progress Schedules, Value Engineering proposals, Safety Plans, Quality Plans, Pre-Construction conference submittals, scanned copies of Affidavit for Compliance with the Prevailing Wage Law (prime retains originals), etc. All documents shall be submitted in standard pdf format, except when otherwise directed by the engineer.

2.2 The Contractor's Affidavit Regarding Settlement of Claims (Form C-242) may be submitted either through an Electronic Notary, or on the original form in a paper medium sealed with the notary attestation.

2.3 The engineer will submit project documents to the contractor via email or through other secure file sharing sites.

2.4 Documents that require multiple signatures, such as change orders, shall include all required signatures on the original electronic document, without scanning.

2.5 Project Payrolls from subcontractors shall be electronically signed by the subcontractor. Payrolls shall be submitted as separate files per contractor per pay period.

3.0 Digital and Electronic Signatures.

3.1 All documents that require signature shall be signed with an electronic signature, except that change orders shall be signed with a registered digital signature in accordance with Section 3.2. Acceptable electronic signatures include any of the following options:

1. A digital signature, either registered or non-registered. A registered digital signature is defined in Section 3.2. Registration is only required for digital signatures on change orders.
2. An electronically written signature by the signee, such as with a stylus pen.
3. Simply typing the name of the author of a document in the signature field is acceptable if the document is also uploaded by the contractor to MoDOT's external Microsoft SharePoint®. This option is authenticated by the user's login credentials which are provided by MoDOT.

3.2 Digital Signature on Change Orders. All change orders shall be executed by the contractor with a registered Digital Signature. The contractor shall submit a letter to the engineer listing all personnel who are authorized to sign change orders on the contractor's behalf. All contractor personnel who are authorized to sign change orders shall create a Digital Signature and shall register their signature with MoDOT by submitting their Digital Signature Certificate (Public Key fdf file) to the Division of Construction prior to signing any change orders. The Public Key file will be used to validate the signee's signature on change orders. To assist contractors with setting up a digital signature, a Quick Reference Guide (QRG) is available in MoDOT's Engineering Policy Guide at <http://epg.modot.org> (click on QRGs in the left hand column and choose "Digital Signature for Adobe Reader").

4.0 Communication. The contractor shall be able to communicate and exchange information with MoDOT staff by email and mobile phone.

5.0 Basis of Payment. No payment will be made for compliance with this provision.

ELECTRONIC INFORMATION FOR BIDDER'S AUTOMATION

07/17

1.0 Description. If electronic information for bidder's automation is provided in the Electronic Deliverables, it is for information only. This information, used for project design and quantity estimation purposes, is provided for the bidder's use in automation of bid estimating, project staking, automated machine guidance and other construction methods.

2.0 Information Provided. Electronic information may be provided consisting of survey and design information including but not limited to 3-dimensional design models, cross-section models, alignment data, and plan view geometry. This information does not constitute part of the bid documents or contract documents.

3.0 Disclaimers. The electronic information shall not be considered a representation of actual conditions to be encountered during construction. Furnishing this information does not relieve a bidder or contractor from the responsibility of making an investigation of conditions to be encountered including, but not limited to site visits, and basing the bid on information obtained from these investigations, and the professional interpretations and judgment of the bidder or contractor. The bidder or contractor shall assume the risk of error if the information is used for any purposes for which the information was not intended. The Commission makes no representation as to the accuracy or reliability of the information, since the information may not be representative of the sealed contract documents. Any assumption the bidder or contractor may make from this electronic information is at the bidder or contractor's risk; none are intended by the Missouri Highways and Transportation Commission. The bidder or contractor assumes the sole risk of liability or loss if the bidder or contractor does rely on this electronic information to its detriment, delay or loss.

4.0 Basis of Payment. No payment will be made for compliance with this provision.

ANTI-DISCRIMINATION AGAINST ISRAEL CERTIFICATION

07/24

By signing this contract, the Company certifies it is not currently engaged in and shall not, for the duration of the contract, engage in a boycott of goods or services from the State of Israel, companies doing business in or with Israel or authorized by, licensed by, or organized under the laws of the State of Israel, or persons or entities doing business in the State of Israel as defined by Section 34.600 RSMo. This certification shall not apply to contracts with a total potential value of less than One Hundred Thousand Dollars (\$100,000) or to contractors with fewer than ten (10) employees.

DISPOSAL OF BLAST MEDIA AND PAINT RESIDUE

07/24

1.0 Description. Whereas Sec 1081.10 requires delivery of Blast Media and Paint Residue (BMPR) produced from bridge coating activities to The Doe Run Company for recycling, and considering the amount of BMPR produced on all active MoDOT projects statewide at any given point in time may exceed the recycling capacity of Doe Run, this provision allows for an alternate method of disposal of BMPR. The contractor, at its discretion, can choose this disposal option or the Doe Run recycle option, when both are available. When Doe Run is not currently capable or agreeable to accept the BMPR, this alternate disposal option shall be considered mandatory, and at no additional cost to the Commission.

2.0 Disposal in Landfill. In lieu of delivery to Doe Run for recycling, BMPR material shall be disposed in the appropriate type of approved landfill, as determined by Toxicity Characteristic Leaching Procedure (TCLP) testing. The material must be TCLP tested to determine if it contains a level of hazardous waste such that requires disposal in a hazardous waste landfill. A sampling plan for testing shall be submitted to MoDOT for review and concurrence. Sampling shall be performed by the contractor. MoDOT will witness the sampling to ensure it is conducted per the plan submitted.

2.1 The contractor shall submit the collected samples to a qualified third-party testing facility to perform TCLP testing. If the sample indicates that the BMPR material qualifies as hazardous waste, then the materials represented by that sample shall be delivered to a licensed hazardous waste landfill for disposal. The contractor shall be responsible for hiring a licensed hazardous waste transporter to transport the hazardous waste to the landfill. The contractor shall comply with all applicable laws and regulations for storage and shipping of the hazardous waste material. If the testing indicates that the BMPR material qualifies as a special waste, it shall be taken to a certified landfill for disposal. The contractor shall be responsible for the transportation of the special waste material to the certified landfill. The requirement to ship the BMPR material by barrels will be waived. Any alternate containers utilized shall comply with all applicable laws and regulations for shipping this type of special waste material. Copies of all shipping manifests, landfill disposal agreements, and any other legally required documentation shall be provided to the engineer.

3.0 Basis of Payment. No payment will be made for any costs associated with this landfill disposal option, including, but not limited to, sampling, testing, delivery, temporary storage, or disposal fees.

DIVISION 600

"POINT OF PRESENCE" SIGNS

03/12; 05/12

1.0 Description. This work shall consist of furnishing and installing a 36 X 48 inch or a 96 X 48 inch "Point of Presence" signs, as indicated in the plans. The contractor shall furnish signs, labor, equipment, posts and hardware for installation of the sign in accordance with this provision or as directed by the engineer.

2.0 Construction Requirements. The sign shall be placed as shown on the plans. A project impacting only one direction of a divided highway will require only one sign. The contractor shall maintain all signs until completion of the project. Upon completion of the project, the "Point of Presence" signs shall remain in place ninety days with the "Completed as Promised" decal or plaque attached. After the ninety day period expires, the contractor shall be required to remove the sign. The sign, decal or plaque, posts and hardware will remain the property of the contractor.

2.1 The 36 X 48 inch "Point of Presence" sign shall be post mounted on two 3-pound/foot U-channel posts, or one-2 ½ inch perforated square steel tube post.

2.2 The 96 X 48 inch "Point of Presence" sign shall be post mounted on three 3-pound/foot U-channel posts with 32-inch spacing between posts.

3.0 Basis of Payment. The accepted quantity of "Point of Presence" signs will be paid for at the contract unit price per square feet of construction signing. The "Completed as Promised" decal or plaque shall be considered incidental to the "Point of Presence" sign.

FLAGGING PROCEDURE FOR TWO-LANE ROADWAYS (3-2-1 CONE PROCEDURE)

04/23

1.0 Description. Flagging operations shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) Chapter 6, Section 107 and 616 in Missouri Standard Specifications for Highway Construction, Missouri Standard Plans for Highway Construction, temporary traffic control plans, and as described herein.

2.0 Procedures for Flagging Short, Intermediate, or Long-Term Stationary Operations. This procedure includes the use of three traffic cones or other channelizing devices. See a pictorial representation in [EPG Article 616.4.5](#).

2.1 Step 1. The flagger shall place three cones across the lane of traffic to be stopped, from centerline to shoulder. When no vehicles are present, the flagger should remain on the shoulder with the stop paddle visible.

2.2 Step 2. When traffic has stopped, the flagger shall move towards the centerline of the roadway, keeping the stop paddle visible, and keeping a visual contact with the stopped drivers. Once the flagger has confirmed that opposing traffic is clear, the flagger shall prepare to release the stopped traffic.

2.3 Step 3a. If the vehicles are to travel in the current lane, the flagger shall remove the center cone from the center of the lane.

2.4 Step 3b. If the vehicles are to travel in the opposite lane, the three cones shall remain across the closed lane.

2.5 Step 4. If opening the lane (Step 3a above) the flagger shall walk back to the shoulder with the cone, turn the stop paddle to slow, and then release traffic using a hand signal to direct vehicles between the two remaining cones. If releasing traffic to the other lane (Step 3b above) the flagger shall remain near the centerline of the roadway, turn the stop paddle to slow, and use a hand signal to direct the traffic around the cones into the open lane.

2.6 Once all traffic has cleared, the flagger shall return the slow paddle to stop. The flagger shall replace the cone to the center of the lane or leave the cones across the lane. The flagger then returns to the shoulder and repeats the steps.

2.7 If the roadway width is less than 12 feet, the number of cones may be reduced to two or one, or other channelizing devices may be used.

3.0 Basis of Payment. No direct payment will be made for any cost associated with this provision.

SUPPLEMENTAL GUIDE SIGNS

07/21

1.0 Description. All installation, relocation and repair of Tourist Oriented Destination Signs (TODS), Specific Service Signing (Logos), traffic generator signs (private tourist-oriented activity sites, Colleges, State and Federal Agency sites, Welcome Center Affiliate sites and State Correctional Centers) shall be coordinated between the engineer, contractor and the designated Program Manager for MoDOT's Supplemental Signing Program.

1.1 It shall be noted by the contractor that the Program Manager is responsible for the installation, relocation and repair of all TODS, Logo and traffic generator signs on Commission owned right of way. The contractor shall be solely responsible for determining if the project will affect these signs due to contractor operations during construction of this contract. The contractor shall be responsible for notifying the Program Manager at the time of the preconstruction meeting when one of these signs is determined to be affected and advise the Program Manager of the project details. The Program Manager will attend these meetings at their discretion and shall be contacted during normal business hours Monday-Friday at the number provided by the engineer.

1.2 The Program Manager will be responsible for any installation or relocation of these signs. If the Program Manager has to perform work within the limits of the project, the Program Manager will conduct work so as not to interfere with or hinder the progress or completion of the work being performed by the contractor. Full cooperation of the contractors involved, in careful and complete coordination of their respective activities in the area, will be required.

2.0 Basis of Payment. No direct payment will be made to the contractor to recover the cost of equipment, labor, materials or time required to fulfill this provision. The Program Manager shall submit an invoice to the engineer for the work completed, with the costs associated being based on the Supplemental Guide Sign Contract agreed upon pricing. This work is considered non-contractual and will be processed through MoDOT's Financial Services Division.

REVISIONS TO 2026 MISSOURI STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION

SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

Delete Sec 102.7.1 and substitute the following:

10/26

102.7.1 Bids shall be submitted using the BidExpress® website. Each bidder shall specify in the bid, in figures, a unit price for each of the separate items listed. The bidder shall not enter zero in any "Unit Price" field unless zero is the intended bid for that item. A unit price left blank will be considered a zero by the Commission. In case of alternate items, unit prices shall be entered for only one alternate in an alternate set. If unit prices are entered for more than one alternate in an alternate set then the bidder is irregular, unless otherwise specified in the bidding documents.

Delete Sec 102.10 and substitute the following:

10/26

102.10. Bids shall be submitted using the BidExpress® website. All bids shall be filed prior to the time specified in the notice to contractors. BidExpress® will not accept any bids submitted after that time.

SECTION 403 – ASPHALTIC CONCRETE PAVEMENT

Delete Sec 403 and substitute the following:

10/26

403.1 Description. This work shall consist of providing a bituminous mixture to be placed in one or more courses on a prepared base or underlying course as shown on the plans or as directed by the engineer. The contractor shall be responsible for QC of the bituminous mixture, including the design, and control of the quality of the material incorporated into the project. The engineer will be responsible for QA, including testing, to assure the quality of the material incorporated into the project.

403.1.1 Naming Convention. The nomenclature of Superpave bituminous mixture names, such as SP125CLP, will be as follows. When only the aggregate size is shown, such as SP125, the specifications shall apply to all variations of that size, such as SP125B, SP125C, SP125CLP, etc. When "x" is indicated, such as SP125xLP, specifications shall apply to all variations of mixture designs. Stone Matrix Asphalt will be generally referred to as SMA and designated by SM or SMR. Balanced Mix Design (BMD) is required on all dense graded SP095 and SP125 surface and base course mixtures as specified herein. All other mixtures, SP048, SP190, SP250, and SM/SMR mixtures shall be considered non-BMD mixtures.

Superpave Nomenclature	
SP	Superpave
048	4.75mm (No. 4) nominal aggregate size
095	9.5 mm (3/8 inch) nominal aggregate size
125	12.5 mm (1/2 inch) nominal aggregate size
190	19.0 mm (3/4 inch) nominal aggregate size
250	25.0 mm (1 inch) nominal aggregate size
x	Mixture design: B, C, E or F (as described below)
LP	Limestone porphyry (when designated)
SM	Stone Matrix Asphalt (when designated)
SMR	Stone Matrix Asphalt limestone/non-carbonate (when designated)

403.1.2 Design Levels. The following cumulative equivalent single axle loads (ESALs) shall be used for the specified mix design. The same size aggregate mix design at a higher design traffic may be substituted at the contractor's expense for the contract specified mixture design with the approval from the engineer. Substitutions shall be done uniformly and project mixing of various designs for the same work will not be permitted. For example, an SP125B mixture may be substituted for an SP125C mixture, or SP190C for SP190E, etc. Mixture design substitution will be limited to one design level higher than that specified in the contract.

Design Traffic (ESALs)	Design
< 300,000	F
300,000 to < 3,000,000	E
3,000,000 to < 30,000,000	C
≥ 30,000,000	B

403.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follow:

Item	Section
Aggregate	1002
Asphalt Binder, Performance Graded (PG) ^a	1015
Fiber Additive	1071
Anti-Strip Additive	1071

^a The grade of asphalt binder will be specified in the contract.

403.2.1 Fine Aggregate Angularity. Fine aggregate angularity (FAA) shall be measured on the fine portion of the blended aggregate. When tested in accordance with AASHTO T 304 Method A, aggregate particles passing the No. 8 sieve shall meet the following criteria for the minimum percent air voids in loosely compacted fine aggregate:

Design ^b	FAA
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F	-- ^a
E	40
C	45
B	45

^a For SP048 Mixtures the FAA shall be a minimum of 40

^b FAA requirements will be waived for BMD SP095 and SP125 Mixtures

403.2.2 Coarse Aggregate Angularity. Coarse aggregate angularity (CAA) shall be measured on the coarse portion of the blended aggregate. When tested in accordance with ASTM D 5821, the coarse aggregate shall meet the following criteria. Crushed limestone, dolomite, steel slag and porphyry will be considered as having 100 percent two fractured faces unless visual observations indicate an undesirable particle shape is being produced.

Design	CAA ^{ab}
F	55/None
E	75/None
C	95/90
B	100/100

^a The criteria denotes the minimum allowable percentage of the coarse aggregate with "one/two" fractured faces, such as a "95/90" requirement, means that the coarse aggregate shall have a minimum of 95 percent particles by weight with one fractured face and a minimum of 90 percent particles by weight with two fractured faces.

^b CAA requirements will be waived for BMD SP095 and SP125 mixtures.

403.2.3 Clay Content. When tested in accordance with AASHTO T 176, blended aggregate particles passing the No. 4 sieve shall meet the following minimum sand equivalent criteria:

Design	Sand Equivalent ^a
F	40
E	40
C	45
B	50

^a Clay content requirements will be waived for BMD SP095 and SP125 mixtures.

403.2.4 Thin, Elongated Particles. For all non-BMD mixtures except SMA, the blended aggregate particles retained on the No. 4 sieve shall not exceed 10 percent, based on a ratio of 5:1 when tested for flat and elongated particles in accordance with ASTM D 4791. Thin and elongated particle testing will be waived on BMD SP095 and SP125 mixtures.

403.2.5 Stone Matrix Asphalt. In addition to other requirements, material for SMA mixtures shall meet the following. Coarse aggregate shall consist of crushed limestone and either porphyry, steel slag or other approved hard durable aggregates in accordance with the quality requirements of Sec 1002, except as follows. The Los Angeles (LA) abrasion, when tested in accordance with AASHTO T 96, shall not exceed 40 percent based on initial ledge approval and source approval. The percent absorption, when tested in accordance with AASHTO T 85, shall not exceed 3.5 percent based on the individual fractions. The amount of flat and elongated particles, measured on material retained on a No. 4 sieve, of the blended aggregate shall not exceed 20 percent based on a 3:1 ratio or 5 percent based on a 5:1 ratio.

403.2.5.1 Filler Restriction. Rigden void content determined in accordance with MoDOT Test Method TM-73 shall be no greater than 50 percent.

403.2.5.2 Fibers. A fiber additive shall be used as a stabilizer in SMA Mixtures. Fibers shall be uniformly distributed by the end of the plant mixing process. The dosage rate for fibers shall be no less than 0.3 percent by weight of the total mixture for cellulose and no less than 0.4 percent by weight for mineral fibers.

403.2.6 Reclaimed Asphalt. A maximum of 30 percent virgin effective binder replacement may be used in mixtures without changing the grade of binder. The asphalt binder content of recycled asphalt materials shall be determined in accordance with AASHTO T 164, ASTM D 2172 or other approved method of solvent extraction. A correction factor for use during production may be determined for binder ignition by burning a sample in accordance with AASHTO T 308 and subtracting from the binder content determined by extraction. The aggregate specific gravity shall be determined by performing AASHTO T 209 in accordance with Sec 403.19.3.1.2 and calculating the G_{se} to which a 0.98 correction factor will be applied to obtain the G_{sb} as follows:

$$G_{se} = \frac{100 - P_b}{\frac{100}{G_{mm}} - \frac{P_b}{G_b}}$$

$$RAP \text{ Gsb} = RAP \text{ Gse} \times 0.98$$

403.2.6.1 Reclaimed Asphalt Pavement. Reclaimed Asphalt Pavement (RAP) may be used in any mixture, except SMA mixtures. Mixtures may be used with more than 30 percent virgin effective binder replacement provided testing according to AASHTO M 323 is included with the job mix formula that ensures the combined binder meets the grade specified in the contract. All RAP material, except as noted below, shall be tested in accordance with AASHTO T 327, *Method of Resistance of Coarse Aggregate Degradation by Abrasion in the Micro-Deval Apparatus*. Aggregate shall have the asphalt coating removed either by extraction or binder ignition during production. The material shall be tested in the Micro-Deval apparatus at a frequency of once per 1500 tons. The percent loss shall not exceed the Micro-Deval loss of the combined virgin material by more than five percent. Micro-Deval testing will be waived for RAP material obtained from MoDOT roadways. All RAP material shall be in accordance with Sec 1002 for deleterious and other foreign material.

403.2.6.2 Reclaimed Asphalt Shingles. Reclaimed Asphalt Shingles (RAS) may be used in any mixture specified to use PG 64-22 in accordance with AASHTO PP 53 except as follows: When the ratio of virgin effective binder to total binder in the mixture is between 60 and 70 percent, the grade of the virgin binder shall be PG 52-28 or PG 58-28. Shingles shall be ground to 3/8-inch minus. Waste, manufacturer or new, shingles shall be essential free of deleterious materials. Post-consumer RAS shall not contain more than 1.5 percent wood by weight or more than 3.0 percent total deleterious by weight. Post-consumer RAS shall be certified to contain less than the maximum allowable amount of asbestos as defined by national or local standards. The gradation of the aggregate may be determined by solvent extraction of the binder or using the following as a standard gradation:

Shingle Aggregate Gradation	
Sieve Size	Percent Passing by Weight
3/8 in.	100
No. 4	95
No. 8	85
No. 16	70
No. 30	50
No. 50	45
No. 100	35
No. 200	25

403.3 Composition of Mixtures.

403.3.1 Gradation. Prior to mixing with asphalt binder, the combined aggregate gradation, including filler if needed, shall meet the following gradation for the type of mixture specified in the contract. A job mix formula may be approved which permits the combined aggregate gradation during mixture production to be outside the limits of the master range when the full tolerances specified in [Sec 403.5](#) are applied.

Sieve Size	Percent Passing by Weight						
	SP250	SP190	BMD SP125	BMD SP095	SP048	SP125xSM(R)	SP095xSM(R)
1 1/2 in.	100	---	---	---	---	---	---
1 in.	90 - 100	100	---	---	---	---	---
3/4 in.	90 max.	90 - 100	100	---	---	100	---
1/2 in.	---	90 max.	90 - 100	100	---	90-100	100
3/8 in.	---	---	90 max.	90-100	100	50-80	70-95
No. 4	---	---	---	90 max.	90-100	20 - 35	30-50
No. 8	19 - 45	23 - 49	28 - 58	32-67	---	16 - 24	20-30
No. 16	---	---	---	---	30-60	---	21 max.
No. 30	---	---	---	---	---	---	18 max.
No. 50	---	---	---	---	---	---	15 max.
No. 100	---	---	---	---	---	---	---
No. 200	1 - 7	2 - 8	2 - 10	2-10	7-12	8.0-11.0	8.0-12.0

403.3.2 Anti-Strip Agent. An anti-strip will be allowed by the engineer to improve resistance to stripping. Anti-strip agents and application rates shall be from a list approved in accordance with Sec 1071. Anti-strip agents shall be required in all mixtures containing flint chat, gravels, individual aggregate fractions containing greater than 5 percent by weight of chert, and asphalt mixtures that have shown poor field performance due to stripping. The liquid anti-strip dosage shall be in the range recommended by the manufacturer and provided in the JMF.

403.3.3 Porphyry Mixtures. For LP and SMA mixtures, at least 50 percent by volume of the aggregate shall be crushed porphyry retained on the following sieves: No. 30 for SP048, No. 16 for SP095 and No. 8 for SP125. Depending on the actual gradation of porphyry aggregate furnished, the amount of crushed porphyry required may vary, however at least 40 percent by weight of crushed porphyry will be required. Steel slag may be substituted for porphyry in LP and SM mixtures, except at least 45 percent by weight of crushed porphyry and/or slag will be required. Other hard, durable, non-carbonate aggregate such as hard chert, crushed gravel, or flint chat may be used in lieu of porphyry and steel slag provided that an approved anti-strip additive is incorporated into the mix and the mixture passes the Hamburg Wheel Track (HWT) test for the total average rut depth and moisture susceptibility in accordance with Sec 403.4.11.3 and Sec 403.4.11.4, respectively. When an SMR mixture is designated, the mixture shall contain aggregate blends with at least 30 percent non-carbonate material in accordance with Sec 403.3.5.

403.3.4 Minimum Stone Matrix Asphalt Binder. The percent asphalt binder for SMA mixtures shall not be less than 6.0 percent unless otherwise allowed and approved by the engineer.

403.3.5 Surface Mixtures. Design level B surface mixtures and SP048NC, except as described in Sec 403.15.3, containing limestone coarse aggregate shall contain a minimum amount of non-carbonate aggregate. The LA abrasion values, AASHTO T 96, of the limestone will determine the type and amount of non-carbonate aggregate required as shown in the table below. The LA abrasion value will be determined from the most recent source approval sample. In lieu of the above requirements, the aggregate blend shall have an acid insoluble residue (AIR), MoDOT Test Method TM 76, meeting the plus No. 4 criteria of crushed non-carbonate material. Non-carbonate aggregate shall have an AIR of at least 85 percent insoluble residue.

Coarse Aggregate (+ No. 4)	Minimum Non-Carbonate by Volume
Limestone, LA ≤ 30	30% Plus No. 4
Limestone, LA > 30	20% Minus No. 4 ^a
Dolomite	No Requirement

^a Use for all SP095 and SP048NC containing limestone.

403.4 Job Mix Formula. At least 30 days prior to placing any mixture on the project, the contractor shall submit a mix design for approval to Construction and Materials. The mixture shall be designed in accordance with AASHTO R 35 or R 46 and shall be tested in accordance with AASHTO T 312 except as noted herein. A detailed description of the mix design process shall be included with the job mix formula (JMF). Representative samples of each ingredient for the mixture shall be submitted with the mix design. Aggregate fractions shall be provided in the same proportions as the proposed job mix formula. A minimum of 150 pounds will be required for any individual fraction. The amount of each ingredient submitted shall be as follows for each mix design to be verified:

Ingredient	Minimum Amount
Aggregate	750 Pounds
Hydrated Lime, Mineral Filler and/or Baghouse Fines	20 Pounds)
Asphalt Binder	10 Gallons

403.4.1 Proficiency Sample Program. Laboratories that participate in and achieve a score of three or greater in the AASHTO proficiency sample program for T 11, T 27, T 84, T 85, T 166, T 176, T 209, T 304 (ASTM C 1252), T 308 and T 312 will have the mixture verification process waived. The mix design shall be submitted to Construction and Materials for approval at least seven days prior to mixture production.

403.4.2 Required Information. The mix design shall include raw data from the design process and contain the following information:

- All possible sources intended for use, and grade and specific gravity of asphalt binder.
- Source, type (formation, etc.), ledge number if applicable, gradation, and deleterious content of each aggregate fraction.
- Bulk and apparent specific gravities and absorption of each aggregate fraction in accordance with AASHTO T 85 for coarse aggregate and AASHTO T 84 for fine aggregate including all raw data.
- Specific gravity of hydrated lime, mineral filler or baghouse fines, if used, in accordance with AASHTO T 100.

- (e) Percentage of each aggregate component.
- (f) Combined gradation of the job mix.
- (g) Percent asphalt binder, by weight, based on the total mixture and percent asphalt binder contributed by reclaimed asphalt materials.
- (h) Bulk specific gravity (G_{mb}) by AASHTO T 166 Method A of a laboratory compacted mixture compacted at N_{design} gyrations.
- (i) Percent air voids (V_a) of the laboratory compacted specimen compacted to N_{design} gyrations.
- (j) Voids in the mineral aggregate (VMA) and voids in the mineral aggregate filled with asphalt binder (VFA) at N_{design} gyrations.
- (k) Theoretical maximum specific gravity (G_{mm}) as determined by AASHTO T 209, in accordance with Sec 403.19.3, after the sample has been short term aged in accordance with AASHTO R 30.
- (l) The tensile strength ratio as determined by AASHTO T 283 including all raw data.
- (m) The gyratory sample weight to produce a 115 mm minimum height specimen.
- (n) Mixing temperature and gyratory molding temperature.
- (o) Number of gyrations at N_{design} .
- (p) Dust proportion ratio ($-200/P_{be}$).
- (q) Bulk specific gravity (G_{sb}) of the combined aggregate.
- (r) Percent chert contained in each aggregate fraction.
- (s) Blended aggregate properties for clay content, angularity, and thin and elongated particles.
- (t) Voids in coarse aggregate (VCA) for both the mixture and dry-rodded condition for SMA mixtures.
- (u) Draindown for SMA mixtures.
- (v) Baghouse fines added for design.
 - (i) Batch and continuous mix plants – Indicate which aggregate fraction to add baghouse percentage during production.
 - (ii) Drum mix plants – Provide cold feed settings with and without baghouse percentage.
- (w) For BMD SP095 and SP125 mixtures all test results shall be submitted along with the raw data. BMD testing shall include Cracking Tolerance Index (CT_{Index}), Long-Term aged Cracking Tolerance Index ($CT_{Index, Long-Term Aged}$), Hamburg Wheel Tracking (HWT) Testing, Rutting Tolerance Index (RT_{Index}) and Moisture Susceptibility results from the HWT test or Tensile Strength Ratio (TSR).

403.4.3 Approval. No mixture will be accepted for use until the JMF for the project is approved by Construction and Materials.

403.4.4 Job Mix Formula Modification. The JMF approved for each mixture shall be in effect until modified in writing by the engineer. When unsatisfactory results occur or should a source of material be changed, a new JMF may be required.

403.4.5 Design Gyrations. The number (N) of gyrations required for gyratory compaction shall be as follows:

Design		N_{design}	
F		50	
E		75	
C		80 or 100	
BSM/BSMR		100	

BMD SP095B/C and SP125B/C		60 Min ^a	
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^a N_{Design} for BMD SP095 and SP125 may exceed 60 gyrations.

403.4.6 Mixture Characteristics. When compacted in accordance with AASHTO T 312, the mixture shall meet the following criteria.

403.4.6.1 Air Voids (V_a). Design air voids for BMD SP095 and SP125 mixtures shall be between 3.0 and 5.0 percent. For SM/SMR and SP048 mixtures, the design air voids shall be 4.0 percent. Design air voids for SP190 and SP250 mixtures shall be 3.0 percent.

403.4.6.2 Voids in the Mineral Aggregate (VMA). BMD SP095 mixtures shall have minimum volume of effective asphalt of 12.0 percent and BMD SP125 mixtures shall have a minimum volume of effective asphalt of 11.0 percent. The minimum VMA for BMD SP095 and SP125 mixtures shall be equal to the minimum volume of effective binder (V_{be}) plus the design air voids.

Mixture	VMA Minimum (percent)
SP250	12.0
SP190	13.0
BMD SP125	V _{be} Minimum + V _{aDesign}
BMD SP095	V _{be} Minimum + V _{aDesign}
SP048	16.0
SMA	17.0

403.4.6.3 Voids Filled With Asphalt (VFA). The minimum VFA for BMD SP095 and SP125, SP190, and SP250 mixtures shall be 72 percent. SMA and SP048 mixtures shall have a minimum VFA of 75 percent.

403.4.7 Dust to Binder Ratio. For all mixtures except SMA and SP048, the ratio of minus No. 200 material to effective asphalt binder (P_{be}) shall be between 0.8 and 1.6. For SP048, the ratio of minus No. 200 material to effective asphalt binder (P_{be}) shall be between 0.9 and 2.0.

403.4.8 Moisture Susceptibility.

For all asphalt mixtures, the mix design shall demonstrate a tensile strength ratio (TSR) greater than 85 percent, or greater than 80 percent when an approved anti-strip agent is used, when the mixture is compacted to 3.7 inches with 7.0 ± 0.5 percent air voids for non-SMA mixtures and 6.0 ± 0.5 percent air voids for SMA mixtures, and tested in accordance with AASHTO T 283.

For BMD SP095 and SP125 mixtures, the HWT moisture susceptibility tests may be used in lieu of TSR and tested in accordance with MoDOT TM-100. The HWT moisture susceptibility criteria shall be in accordance with Sec 403.4.11.4.

403.4.9 Draindown. AASHTO T 305, Draindown Test, shall be performed on all SMA mixtures prior to job mix approval. The mixture shall be stabilized in such a way that the draindown of the asphalt binder shall not exceed 0.3 percent by weight of mixture.

403.4.10 Voids in Coarse Aggregate. The percent VCA_{MIX} of SMA mixtures shall be less than or equal to the VCA_{DRC} as determined using AASHTO T 19. This may be calculated using the following equations:

$$VCA_{DRC} = 100 \times (G_{CA}\gamma_w - \gamma_s) / G_{CA}\gamma_w$$

$$VCA_{MIX} = 100 - (P_{bp} \times G_{mb} / G_{CA})$$

$$P_{bp} = P_s \times PA_{bp}$$

Where:

G _{CA}	=	bulk specific gravity of the combined coarse aggregate (AASHTO T 85),
γ _s	=	unit weight of coarse aggregate in the dry-rodded condition (DRC) (lb/ft ³) (AASHTO T 19),
γ _w	=	unit weight of water (62.34 lb/ft ³),
P _{bp}	=	percent aggregate by total mixture weight retained on No. 4 sieve and
PA _{bp}	=	percent aggregate by total aggregate weight retained on No. 4 sieve*.

*Use No. 8 sieve for SP095xSM

403.4.11 Performance Testing Requirements for BMD SP095 and SP125 Mixtures. Acceptable test results meeting the criteria of the following performance tests shall be submitted with the mix design for approval. Test specimens shall be compacted to an air void content of 7.0 ± 0.5 percent.

403.4.11.1 Cracking Tolerance Index (CT_{Index}) Testing. The CT_{Index} testing shall be completed in accordance with ASTM D8225 and at a test temperature of 25 ± 0.5 C. BMD SP095 and SP125 mixtures shall meet the following criteria.

Mix Type	Minimum CT _{Index}	Minimum CT _{Index} (Long-Term Aged) ^a
BMD SP095 and SP125 Mixtures	50	15

^a Long-Term Aged defined as loose mix aging for 20 hours at 115 C.

403.4.11.2 Rutting Tolerance Index (RT_{Index}) Testing. The RT_{Index} testing shall be completed in accordance with ASTM D8360 and at a test temperature of 50 ± 1 C and should meet the following criteria for the contract binder grade of the mixture.

Binder Contract Grade ^a	Minimum RT _{Index} ^b
58-28H / 64-22	50
64-22H / 70-22	65
64-22V / 76-22	80

^a Determined by the binder grade specified in the contract.

^b The RT_{Index} test value shall be reported, but the Hamburg wheel track test (HWT) rutting requirement shall govern mixture acceptance.

403.4.11.3 Hamburg Wheel Track (HWT). HWT testing will be completed in accordance with AASHTO T 324 at test temperature of 50 ± 1 C and 2.44 inch specimen height. All HWT testing shall be conducted with 20,000 passes along with the raw data.

Binder Contract Grade ^a	Minimum Wheel Passes	Maximum Rut Depth (mm)
58-28H / 64-22	7,500	10
64-22H / 70-22	15,000	10
64-22V / 76-22	20,000	10

^a Determined by the binder grade specified in the contract.

403.4.11.4 Hamburg Wheel Track (HWT) Moisture Susceptibility Requirements. If elected by the contractor for BMD SP095 and SP125 mixtures or when required by the mix design, one of the following moisture susceptibility criteria may be used in lieu of TSR using total rut depth, slope ratio (SR), and stripping inflection point (SIP) to determine passing moisture resistance using the HWT. The HWT test shall be completed to 20,000 passes regardless of the contract grade for calculating the SR and the SIP in accordance with MoDOT TM-100.

Parameter	Stripping Criteria	Outcome
Total Rut Depth	Less Than or Equal to 4 mm	Passes Stripping Test
Slope Ratio (SR)	Less Than 2.0	Passes Stripping Test
Stripping Inflection Point (SIP)	Greater Than 15,000 passes	Passes Stripping Test

403.5 Mixture Production Specification Limits.

403.5.1 Gradation and Deleterious Content Control. The gradation of the aggregate shall be determined from samples taken from the hot bins on batch-type or continuous mixing plants or from the composite cold feed belt on drum mix plants. The gradation may also be obtained by sampling the mixture and testing the residual aggregate. The deleterious content of the aggregate shall be determined from samples taken from the composite cold feed belt. Aggregate samples shall be taken in accordance with AASHTO R 90. The RAP shall be sampled from the RAP feeding system on the asphalt plant. The contractor shall determine the gradation on the aggregate reclaimed from the RAP by either extraction or binder ignition. The results shall be used to determine specification compliance for the combined gradation.

403.5.1.1 Stone Matrix Asphalt Tolerances. In producing mixtures for the project, the plant shall be operated such that no intentional deviations from the job mix formula are made. The maximum deviation from the approved job mix formula shall be as follows for SMA mixtures:

Sieve	Max. Tolerance
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	SP095	SP125
3/4 in.	---	---
1/2 in.	---	±4
3/8 in.	±4	±4
No. 4	±3	±3
No. 8	±3	±3
No. 200	±2	±2

403.5.1.2 Mixture Tolerance. For all other SP mixtures, the percent passing the first sieve size smaller than the nominal maximum size shall not exceed 92.0 percent, a tolerance not to exceed 2.0 percent on the No. 8 sieve from the table in Sec 403.3.1, and within the range listed in Sec 403.3.1 for the No. 200 sieve. The deleterious content of the material retained on the No. 4 sieve shall not exceed the limits specified in Sec 1002.2.

403.5.2 Density. The final, in-place density of the mixture shall be 92.5 to 98.5 percent of the theoretical maximum specific gravity for all mixtures except SMA. SMA mixtures shall have a minimum density of 94.0 percent of the theoretical maximum specific gravity. The theoretical maximum specific gravity shall be determined from a sample representing the material being tested. Tests shall be taken not later than the day following placement of the mixture. The engineer will randomly determine test locations.

403.5.2.1 Non-Integral Shoulder Density. Non-integral shoulders with subgrade or base density controls per Sec 209 shall meet the specified density requirements for the mixture. For non-integral shoulders constructed on an existing older paved shoulder, or on a subgrade or base that does not require Sec 209 subgrade preparation, density requirements shall be in accordance with Sec 401.7.8. All compaction shall be completed within the compaction temperature range of the asphalt mixture in accordance with Sec 403.15.

403.5.2.2 Integral Shoulder Density. When shoulders are placed integrally with the traveled way, density tests shall be taken on the traveled way for density pay factors. The rolling pattern for an integral shoulder shall be the same as that used for the mainline traveled way unless compaction causes pavement distress. If distress occurs, the contractor shall immediately notify the engineer and develop a rolling pattern that provides optimum density and performance. After a rolling pattern has been shown to achieve optimum density, it shall be used in place of density testing unless material, location, subgrade condition, or temperature changes. The engineer may require additional density tests to confirm that optimum density is obtained. All compaction shall be completed within the compaction temperature range of the asphalt mixture in accordance with Sec 403.15.

403.5.2.3 Unconfined Longitudinal Joint Density. Density along unconfined longitudinal joints shall be in accordance with Sec 403.16.1 and Sec 403.23.6.

403.5.3 Asphalt Content. The asphalt content (AC) shall be within ± 0.3 percent of the approved mix design.

403.5.4 Voids in the Mineral Aggregate. The VMA shall be within -0.5 and $+2.0$ percent of the minimum required for each type of mixture at N_{des} gyrations.

403.5.5 Air Voids. Air voids shall be within ± 1.0 percent of the approved mix design at N_{des} gyrations.

403.5.6 Tensile Strength Ratio. The TSR shall be greater than or equal to 80 percent as determined from loose mixture taken from the asphalt plant and tested in accordance with AASHTO T 283.

403.5.7 Aggregate Properties. Aggregate properties from Sec 403.2 on the combined aggregate during production shall be no less than 2 percent below the minimum for FAA, no less than 5 percent below the minimum for CAA, no less than 5 percent below the minimum for clay content and no more than 2 percent above the maximum for thin, elongated particles. Samples are to be taken from the combined cold feed whether from a drum-mix plant or a batch plant. Samples are to be taken in accordance with AASHTO R 90. Testing of aggregate consensus properties for BMD SP095 and SP125 mixtures are waived.

403.5.8 Fibers. The fiber proportioning and delivery system for SMA mixtures shall have an accuracy of 10 percent by weight of the material actually being measured in any given period of time.

403.5.9 Moisture Content. The asphaltic concrete mixture, when sampled and tested in accordance with AASHTO T 329, shall not contain more than 0.5 percent moisture by weight of the mixture.

403.5.10 Contamination. The asphaltic concrete mixture shall not be contaminated with deleterious agents such as unburned fuel, objectionable fuel residue or any other material not inherent to the job mix formula.

403.5.11 BMD SP095 and SP125 Mixture Testing. BMD SP095 and SP125 mixtures performance testing shall have favorable QC/QA comparisons and meet the minimum criteria described herein.

403.5.11.1 Cracking Tolerance Index (CT_{Index}). Minimum CT_{Index} shall be 50 for BMD SP095 and SP125 mixtures.

403.5.11.2 Mixture Stability. Minimum Rutting Tolerance Index (RT_{Index}) or maximum rutting measured by the Hamburg Wheel Track (HWT) test shall be in accordance with the following:

Contract Binder Grade ^a	Minimum RT _{Index} ^b	Maximum Average Rut Depth by HWT (mm) ^c
58-28H / 64-22	50	12.5 mm @ 7,500 Passes
64-22H / 70-22	65	12.5 mm @ 15,000 Passes
64-22V / 76-22	80	12.5 mm @ 20,000 Passes

^a Determined by the contract binder grade specified in the contract.

^b HWT testing may replace RT_{Index} testing for contract compliance. A minimum RT_{Index} may be established during production for correlation with HWT results; however, this is permitted only when the measured HWT rut depth during production is 10 mm or less. If the HWT rut depth is 10 mm or less, the lower RT_{Index} value shall govern. Mixtures failing to meet the minimum RT_{Index} or the correlated minimum RT_{Index} shall be tested using the HWT.

^c Raw data for the HWT shall be provided for 20,000 passes for all mixtures regardless of binder contract grade. Maximum HWT rut depth of 12.5 mm of rutting shall be determined at the required number of passes for the contract asphalt binder grade.

403.5.11.3 Moisture Susceptibility of BMD SP095 and SP125 Mixtures. Moisture susceptibility shall be measured by TSR or by HWT tests. The TSR shall be greater than or equal to 80 percent as determined from loose mixture taken from the plant and tested in accordance with AASHTO T 283. Alternatively, the moisture susceptibility shall pass one of the following criteria in the following table from the HWT test for maximum average rutting, slope ratio (SR), or stripping inflection point (SIP) in accordance with MoDOT TM-100.

Hamburg Wheel Track (HWT) Moisture Susceptibility (Stripping) Criteria		
Parameter	Stripping Criteria	Outcome
Total Rut Depth	Less Than or Equal to 4 mm	Passes Stripping Test
Slope Ratio (SR)	Less Than 2.0	Passes Stripping Test
Stripping Inflection Point (SIP)	Greater Than 15,000 passes	Passes Stripping Test

403.5.11.3.1 Moisture Susceptibility for the Acceptance of other Hard Durable Aggregates in Porphyry Mixtures. HWT shall be used during production to evaluate moisture susceptibility for acceptance when other hard durable aggregates are used in lieu of either crushed porphyry or steel slag.

403.6 Field Laboratory. The contractor shall provide a Type 3 field laboratory in accordance with Sec 601. The contractor shall furnish the bituminous mixture equipment to perform all required test methods for QC and QA work. The gyratory compactor shall be evaluated in accordance with AASHTO PP 35. An approved list will be maintained by Construction and Materials. All other equipment shall be capable of performing tests in accordance with the approved test methods.

403.7 Bituminous Mixing Plants. Bituminous mixing plants and preparation of material and mixtures shall be in accordance with Sec 404.

403.8 Hauling Equipment. Trucks used for hauling bituminous mixtures shall be in accordance with Sec 404.

403.9 Pavers. Bituminous pavers shall be self-contained units, provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading and finishing asphaltic concrete in lane widths applicable to the specified typical sections and thicknesses shown on the plans.

403.10 Construction Requirements.

403.10.1 Weather Limitations. No mixture shall be placed on any wet or frozen surface. No mixture shall be placed when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 40 F. Temperatures shall be obtained in accordance with MoDOT Test Method TM 20.

403.10.2 Substitutions. With approval from the engineer, the contractor may substitute a smaller nominal maximum size mixture for a larger sized mixture. Specifications governing the substitute mixture shall apply. Except for a single surface layer, the total pavement thickness shall be maintained when the substitute mixture layer is reduced as allowed in Sec 403.13 by increasing the thickness of other layers or courses. The contract unit price for the original mixture shall be used.

403.11 Field Adjustments of Job Mix Formulas. When test results indicate the mixture produced does not meet the specification requirements, the contractor may field adjust the job mix formula as noted herein. Field adjustments may consist of changing the percent binder as listed on the original approved job mix by no more than 0.3 percent. Additional fractions of material or new material will not be permitted as field adjustments. The engineer shall be notified immediately when any change is made in the cold feed settings, the hot bin settings or the binder content. A new G_{sb} shall be calculated using the new aggregate percentages. The gradation of the adjusted mixture shall meet the requirements of the mixture type specified in the contract. When the binder content is adjusted more than 0.3 percent, the mixture will be considered out of specification, and a new mix design shall be established.

403.11.1 Field Mix Redesign. When a new mix design will be required, the contractor will be permitted to establish the new mix design in the field. The mixture shall be designed in accordance with AASHTO R 35 or AASHTO R 46 and shall meet the mix design requirements, balanced mix design requirements (if required), including TSR or HWT moisture susceptibility requirements. A representative sample of the mixture shall be submitted with the new mix design to the Central Laboratory for mixture verification. The amount of mixture submitted for verification shall weigh at least 50 pounds.

403.11.1.1 Approval. New mix designs established in the field shall be submitted for approval to Construction and Materials. Upon approval, Construction and Materials will assign a new mix number to the mixture.

403.11.1.2 Resume Production. No mixture shall be placed on the project until the new field mix design is approved.

403.12 Application of Prime or Tack. The prime coat, if specified, shall be applied in accordance with Sec 408. A tack coat is required on all existing pavement and shoulder surfaces that will be overlaid with a bituminous mixture. A tack coat is also required between all lifts of bituminous pavements placed within the driving and turn lanes, unless otherwise specified in the contract. All construction requirements of a tacked surface shall be in accordance with Sec 407, and specified herein. The tack coat shall be applied uniformly and shall completely cover the surface upon which the bituminous mixture is to be placed. Placement of a bituminous mixture shall not be placed upon a tacked surface that is not uniformly covered or surfaces that have experienced excessive loss of tack due to tracking. Re-application of tack due to excess tracking or non-uniform coverage shall be at the contractor's expense.

403.13 Spreading and Finishing. The base course, primed or tacked surface, or preceding course or layer shall be cleaned of all dirt, packed soil or any other foreign material prior to spreading the asphaltic mixture. If lumps are present or a crust of mixture has formed, the entire load will be rejected. The thickness and width of each course shall conform to the typical section in the contract. The contractor may elect to construct each course in multiple layers. The minimum compacted thickness as a wearing surface shall be 1 inch for SP048, 1.5 inches for SP095, 2 inches for SP125, 3 inches for SP190, and 4 inches for SP250. For leveling courses, the minimum compacted thickness can be reduced by 0.25-inches.

403.13.1 Uneven Lanes. For roadways constructed under traffic, uneven pavement lanes shall not be left in place for more than seven days, unless approved by the engineer.

403.13.2 Segregation. No segregation will be permitted in handling the mixture at the plant, from the truck or during spreading operations on the roadbed. All layers shall be feathered out, by hand raking if necessary, in transitioning the depth of the surface to meet present grades at bridges or ends of projects, to provide a uniform, smooth riding surface free of irregularities. Where only the top layer of the surfacing continues across a bridge, the bottom layers shall be feathered out. In situations where there is a dispute in the existence of segregation, the area in question will be tested in accordance with MoDOT Test Method TM 75. Mixture production shall immediately cease if either criteria of MoDOT Test Method TM 75 fail. Segregated mixture shall be removed and replaced to the limits determined by the engineer.

403.13.2.1 Paver Mounted Thermal Profiling (PMTP). PMTP data shall be required behind the asphalt paver on the roadway for BMD SP095 and SP125 mixtures in accordance with Sec 406. For all other asphalt mixtures, a material transfer vehicle (MTV) shall be required.

403.13.3 Release to Traffic. If the asphaltic concrete construction consists of more than a single layer, each layer shall be compacted as specified and allowed to cool to the ambient temperature before the next layer is placed. The contractor shall keep traffic off the asphaltic concrete until the surface of the asphaltic concrete is 140 F or below and the asphaltic concrete has cooled sufficiently to prevent flushing of the asphalt binder to the surface, marking or distorting the surface or breaking down the edges.

403.13.4 Draindown. Evidence of asphalt binder separation or draindown at delivery will be cause for rejection.

403.13.5 Shoulder Substitution. When a Sec 403 mixture is specified for traffic lanes, the same mixture may be used for the adjacent shoulder, subject to the density requirements in Sec 403.5.2.

403.14 Spot Wedging and Leveling Course. The engineer will specify the locations and thickness of spot wedging and the thickness of leveling course to obtain the smoothest possible riding surface. This procedure may result in spot wedging operations over small areas with feather-edging at high points and ends of wedge areas. Rigid control of the placement thickness of the leveling course shall be required. Leveling course, consisting of a layer of asphaltic concrete of variable thickness used to superelevate curves and eliminate irregularities in the existing base, shall be spread uniformly to the specified profile grade and cross section. The mixture shall be uniformly spread and compacted, with only minor segregation as accepted by the engineer. Type SP125 or finer mixtures, as applicable, shall be used for the spot wedging and for the leveling course.

403.15 Compaction. After the asphaltic mixture has been spread, struck off and surface irregularities adjusted, the asphaltic mixture shall be compacted thoroughly and uniformly by rolling to obtain the required compaction while the mixture is in a workable condition. Excessive rolling, to the extent of aggregate degradation, will not be permitted. Rollers shall not be used in the vibratory mode when the mixture temperature is below 225 F. When warm mix technology is used, as approved by the engineer, rollers shall not be used in the vibratory mode when the mixture temperature is below 200 F.

403.15.1 Rolling. Any displacement occurring as a result of starting, stopping or changing direction of a roller, or from other causes, shall be avoided. Excess liquid, to prevent adhesion of the mixture to the rollers, will not be permitted. Diesel fuel, fuel oil or other detrimental products shall not be used as wetting agents. Along forms, curbs, headers, walls and other places not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons or with mechanical tampers.

403.15.2 Defective Mixture. Any mixture that becomes loose and broken, mixed with dirt or is in any way defective shall be removed and replaced with fresh, hot mixture, which shall be compacted to conform with the surrounding area. Any area showing an excess or deficiency of asphalt binder shall be removed and replaced.

403.15.3 Other Non-Traffic Areas. All mixtures used for other non-traffic areas such as surfacing medians and similar areas with subgrade or base density controls per Sec 209 shall meet the specified density requirements for the mixture. For non- traffic areas constructed on an older existing pavement or on a subgrade or base that does not require Sec 209 subgrade preparation, density requirements shall be in accordance with Sec 401.7.8. Temporary bypasses to be maintained at the expense of the contractor shall be thoroughly compacted in accordance with Sec 401.7.8. All compaction shall be completed within the compaction temperature range of the asphalt mixture in accordance with Sec 403.15.

403.15.4 Density Measurement. Measurements for determining the in-place density of the mixture shall be taken no later than the day following placement. Measurements not obtained within the prescribed time limits shall be subject to the requirements of Sec 403.22. If a core is taken, material from underlying layers that remain adhered to the core shall be removed in a manner that does not harm the integrity of the specimen. If the contractor elects to place a lift of mixture greater than six times the nominal maximum aggregate size, cores shall be cut in half and the density of each half determined separately.

403.16 Joints. Transverse joints shall be formed by any method that will produce a dense, vertical section for use when laying is resumed. When a transverse vertical edge is to be left and opened to traffic, a temporary depth transition shall be built as approved by the engineer. The joint formed when the fresh mixture is placed shall be dense, well sealed, and the grade, line and surface texture of the succeeding surface shall conform to that of the joined surface. If directed by the engineer, the transverse joint shall be painted with a light coating of liquid asphalt. Hand manipulation of the mixture shall be minimized to avoid unsightly surface texture.

403.16.1 Joint Composition. Longitudinal joints shall be formed by the use of an edging plate fixed on both sides of the finishing machine. Care shall be taken to obtain a well bonded and sealed longitudinal joint by placing the hot mixture in a manner ensuring maximum compaction at this point. If directed by the engineer for properly sealing the longitudinal joint, a light coating of bituminous material shall be applied to the exposed edge before the joint is made. The minimum density of all traveled way pavement within 6 inches of a longitudinal joint, including the pavement on the traveled way side of the shoulder joint, shall not be less than 2.0 percent below the specified mat density when unconfined. The density of the longitudinal joint when confined will be included in the evaluation of the remainder of the mat. Each side of the joint shall be flush and along true lines.

403.16.2 Joint Offset. The longitudinal joint in any layer shall offset that in the layer immediately below by a minimum of 6 inches; except, the joints in the completed surfacing shall be at the lane lines of the traveled way or other required placement width outside the travel lane. The placement width shall be adjusted such that pavement marking shall not fall on a longitudinal joint.

403.17 Quality Control.

403.17.1 Quality Control Operations. The contractor shall maintain equipment and qualified personnel to perform all QC field inspection, sampling and testing as required by this specification. All contractor personnel included in the QC operation shall be qualified by the MoDOT Technician Certification Program. Under no circumstances will unqualified personnel be allowed to perform QC sampling or testing. Personnel will be disqualified if acceptable methods and procedures are not followed.

403.17.1.1 Asphalt Test Results. The contractor shall record all test results and furnish a copy, including all raw data, to the engineer no later than the beginning of the day following the test. The contractor shall maintain all test results in an organized format and shall be available to the QA inspector at all times. Scale readings and other measurements not directly recorded by electronic media shall be recorded in an organized format. Printouts from gyratory compactors and asphalt content devices shall be retained as part of the testing records.

403.17.2 Bituminous Quality Control Plan. Prior to approval of the trial mix design by the engineer, the contractor shall submit a QC Plan to Construction and Materials for approval. The QC Plan shall include:

- (a) The contractor representative in charge of QC and the project level representative if different from the contractor representative. Contact information should be recorded for these individuals.
- (b) Lot and subplot sizes and how they will be designated.
- (c) Where samples will be taken - Plant or roadway sampling.
- (d) The test method for determining asphalt content, BMD tests (if applicable), and number of cores to be cut for density determination.
- (e) Paver Mounted Thermal Profiler base station or cellular reception plan with Global Navigation Satellite System (GNSS) accuracy and the QC contact person for data collection and processing.
- (f) A proposed independent third party name, contact, address, and phone number for dispute resolution.

403.17.2.1 Third Party. The third party shall be independent of the contractor, MoDOT consultants and all project subcontractors or suppliers on each specific project. All testing of material for dispute resolution shall be performed by an approved laboratory. Approved laboratories shall be AASHTO Accreditation Program certified in the areas of the material being tested.

403.17.2.2 Plant Calibration. Plant calibration shall be performed by the contractor in accordance with Sec 404, and records shall be made available to the engineer.

403.17.2.3 Retained Samples. All samples taken by the contractor, including but not limited to tested aggregate, volumetric, BMD loose mix and density samples, shall be retained for the engineer for a minimum of seven days after the contractor's tests are complete and accepted unless otherwise instructed. These samples shall be maintained in clean covered containers, without contamination, readily accessible to the engineer. The retained sample's identification shall consist of, but is not limited to:

- (a) Time and date sampled.
- (b) Product specification number.
- (c) Type of sample, i.e. belt, bin, stockpile.
- (d) Lot and subplot designation.
- (e) Sampler/Tester.
- (f) Project Job Number.

403.17.2.3.1 Gradation and Deleterious Content Samples. For each gradation and deleterious sample taken, the contractor shall retain for the engineer, the portion of the sample not tested after reducing the original sample to testing size.

403.17.2.3.2 Loose Mix Sample. All loose mix samples for determination of volumetrics, asphalt binder content and TSR shall be taken either from the roadway or at the asphalt plant. Samples for BMD testing shall be taken from the asphalt plant. Sampling will be performed randomly as designated by the engineer. A companion loose mix sample shall be taken, identified and retained for the engineer.

403.17.3 Quality Control Laboratory. All QC mixture testing shall be performed in an approved laboratory.

403.17.3.1 Calibration Schedule. The contractor shall calibrate or verify all significant test equipment associated with tests covered in this specification. Intervals as set by the contractor shall not exceed the following limits:

Equipment - Test Method (AASHTO)	Requirement	Interval (Month)
Gyratory Compactor - T 312	Calibrate – $1.16 \pm .02^\circ$ internal angle	12 ^a
Gyratory Compactor - T 312	Verify	1 ^c
Gyratory Molds - T 312	Check Critical Dimensions	12
Thermometers - T 209, T 166, T 312	Calibrate	12
Hamburg Wheel Track – R 18	Calibrate	12
Performance Testing Load Frames - R18	Calibrate	12
Water Baths	Verify Temperature	12
Vacuum System - T 209	Check Pressure	12
Pycnometer (Flask) - T 209	Calibrate	Daily
Binder Ignition Oven - T 308	Verify	12 ^b
Nuclear Content Gauge – T 287 or MoDOT TM 54	Drift & Stability – Manuf. Recommendation	1
Mechanical Shakers - T 27	Check Sieving Thoroughness	12
Sieves	Check Physical Condition	6
Weighted Foot Assembly - T 176	Check Weight	12
Mechanical Shaker - T 176	Check Rate & Length of Throw	12
Liquid Limit Device - T 89	Check Wear & Critical Dimensions	12
Grooving Tool - T 89	Check Critical Dimensions	12
Ovens	Verify Temp. Settings	12
Balances	Verify	12 ^b
Timers	Check Accuracy	12

^a Calibrate and/or verify after each move.

^b Verify after each move.

^c Includes ram pressure, LVDT, frequency of gyration, and external angle.

403.17.3.1.1 Inventory. An inventory of all major sampling, testing, calibration and verification equipment, including the serial number or other identifying number shall be maintained.

403.17.3.1.2 Calibration Records. Calibration and verification records shall include but are not limited to:

- (a) Detailed results of the work performed (dimensions, mass, force, temperature, etc.)
- (b) Description of the equipment calibrated including identifying number.
- (c) Date the work was performed.
- (d) Identification of the individual performing the work.
- (e) Identification of the calibration or verification procedure used.
- (f) The previous calibration or verification date and next due date.
- (g) Identification of any in-house calibration or verification device used (including identification to establish traceability of items such as standard masses, proving rings, standard thermometers, balances, etc.).

403.17.3.2 Record Retention. Test records shall be maintained to permit verification of any test report. Records pertaining to testing, equipment calibration and verification, test reports, internal quality systems review, proficiency sample testing, test technician training and evaluation and personnel shall be retained in a secure location for a minimum of three years.

403.17.3.3 Test Method Availability. A current copy of all test methods and procedures shall be maintained in the QC laboratory at all times for reference by the technicians. Examples of report formats and procedures may be found in AASHTO R 18.

403.18 Quality Assurance. All QA field inspection, sampling and testing will be performed by a qualified MoDOT technician. The QA inspector shall have free access to any and all testing equipment used by the mixture producer and any workbooks, records

or control charts maintained by the mixture producer for the QC process. The QA inspector shall also have sufficient access to the plant grounds to assure compliance with the approved QC Plan.

403.18.1 Assurance Testing. The engineer will independently sample and test the mixture from the location designated by the QC plan (asphalt plant or from the roadway) at the frequency listed in Sec 403.19.3. The independent sample will be of sufficient size to retain half for possible disputes. Further testing of this sample will be under the direction of the engineer. The retained portion of the QC samples for mixture properties, gradation, and deleterious content will be tested at a frequency no less than once per week. The engineer's test results, including all raw data, will be made available to the contractor when completed and no later than the next working day. For BMD SP095 and SP125 mixtures sampled at the plant, the contractor shall assist the engineer in sampling and fabricating BMD test specimens at the frequency listed in the applicable portions of Sec 403.19.3. QA shall conduct independent BMD testing at the provided random tonnage.

403.18.2 Core Chain of Custody. QA density cores shall be sealed in approved tamper-evident containers immediately after extraction in the presence of the engineer.

403.18.3 Aggregate Comparison. Comparison for aggregate will be considered favorable when the contractor's QC results and the engineer's QA test results of a retained sample compare within the following limits. For BMD SP095 and SP125 mixtures, field testing requirements of aggregate consensus properties will be waived and conducted only as necessary to determine mix issues.

403.18.3.1 Gradation. Gradations shall apply to all asphalt mixtures.

Sieve Size	Percentage Points
3/4 inch and larger	5.0
1/2 inch	5.0
3/8 inch	4.0
No. 4	4.0
No. 8	3.0
No. 10	3.0
No. 16	3.0
No. 20	3.0
No. 30	3.0
No. 40	2.0
No. 50	2.0
No. 100	2.0
No. 200	1.0

403.18.3.2 Coarse Aggregate Angularity. Angular particles shall be within 5 percentage points.

403.18.3.3 Fine Aggregate Angularity. Void content shall be within 2 percentage points.

403.18.3.4 Sand Equivalent. Sand equivalency shall be within 8 percentage points.

403.18.3.5 Thin, Elongated Particles. Flat, elongated particle content shall be within one percentage point.

403.18.3.6 Deleterious. The total and individual deleterious content shall not exceed the specification limits.

403.18.4 Federal Highway Administration Requirements. Performance and acceptance of QC/QA testing under these specifications shall not eliminate any FHWA requirements for acceptance of the material.

403.19 Acceptance of Material. Acceptance of bituminous mixture will be based on lots. Material will be sampled from either the asphalt plant or the roadway behind the paver in lots or sublots on a random basis through the use of a random number system and evaluated using a Quality Level Analysis (QLA). A QLA will determine payment based on a combination of the total PWL (PWL_t) determined for each pay factor item for each lot of material produced.

403.19.1 Random Numbers. The engineer will generate random numbers.

403.19.2 Lots. A lot shall consist of no more than 6,000 tons. The maximum subplot size shall be 1,000 tons and each lot shall contain no less than four (4) sublots. Sublots from incomplete lots shall be combined with the previous complete lot for determination of pay factors. When no previous lot exists, the mixture shall be treated in accordance with Sec 403.23.9.4.1. A new lot shall begin when the asphalt content of a mixture is adjusted in accordance with Sec 403.11, if there is an asphalt binder grade change, or an additive source change.

403.19.3 Test and Pay Factor Items. As a minimum, the contractor and engineer shall test in accordance with the following tables. Table 1 testing requirements shall apply to BMD SP095 and SP125 mixtures. Table 2 testing requirements shall apply to all non-BMD asphalt mixtures. The number of random tests per subplot may be increased per the contractor's QC plan. The QC plan shall state the test and testing frequency. All random tests shall be used in the pay factor determination. Where multiple test methods are allowed, the contractor shall designate the test method to be used in the QC Plan. Final payment will be based on the indicated pay factor items.

Table 1 - Balance Mix Design for SP095 and SP125 Mixtures				
Tested Property	PWL Pay Factors	Test Method	Contractor Frequency	Engineer Frequency
Mat Density (% of theoretical maximum density) ^a	Yes	MoDOT Test Method TM 41 or AASHTO T 166 ^d	1 Sample / Sublot; as needed for joints and shoulders	1 Sample / Lot
Asphalt content	Yes	AASHTO T 164, or MoDOT Test Method TM-54, or AASHTO T 287, or AASHTO T 308	1 / Sublot	1 / Lot
V _a , N _{des} ^b	Yes	AASHTO T 312 and R 35	1 / Sublot	1 / Lot
VMA, N _{des} ^b	No	AASHTO T 312 and R 35	1 / Sublot	1 / Lot
CT _{Index} ^c	No	ASTM D 8225 @ 25 ± 0.5° C	1 / 6,000 tons	1 / 12,000 tons
Unconfined Longitudinal Joint Density ^a	No	MoDOT Test Method TM 41 or AASHTO T 166 ^d	1 Sample / Sublot	1 Sample / Lot
RT _{Index} or HWT	No	ASTM D 8360 / AASHTO T 324; @ 50 ± 1° C	1 / 6,000 tons	1 / 12,000 tons
Moisture Susceptibility: TSR or HWT ^e	No	AASHTO T 283 / MoDOT Test Method TM-100	1 / 12,000 tons	1 / 48,000 tons
Cold feed or hot bin gradation	No	AASHTO T 27	1 / 2 Sublots	1 / Lot
Mixture Temperature	No	---	1 / Sublot	1 / Day
Temperature of Base and Air	No	---	As Needed	As Needed

^a Core samples shall consist of one core. Up to two additional cores may be obtained at the same offset within six feet of the randomly selected location. If more than one core is obtained, all cores shall be used and combined into one sample.

^b Based on the average of a minimum of two compacted specimens.

^c Payment will be based upon the table in Sec 403.23.7.

^d AASTHO T 331 shall be required when absorptions of the specimens are greater than 2.0 percent and may be substituted for AASHTO T 166.

^e HWT shall be used to evaluate moisture susceptibility for acceptance when other hard durable aggregates are used in lieu of either crushed porphyry or steel slag.

Table 2 – Non-BMD Asphalt Mixtures				
Tested Property	Pay Factor	Test Method	Contractor Frequency	Engineer Frequency
Mixture temperature	No	----	1/Sublot	1/day
Temperature of base and air	No	----	As needed	As needed

Mat Density (% of theoretical maximum density) by contractor	Yes	MoDOT Test Method TM-41 or AASHTO T 166 ^e	1 Sample ^b /Sublot As needed for joints & shoulders.	1 Sample/Lot
Unconfined Joint Density	No	MoDOT Test Method TM-41 or AASHTO T 166 ^e	1 Sample ^b /Sublot	1 Sample/Lot
Cold feed or hot bin gradation and deleterious content	No	AASHTO T 27 and AASHTO T 11	1/2 Sublots	1/Lot
Ground shingles	No	AASHTO T 27	1/12,000 tons with a minimum of 1/project	1/project
FAA, CAA, Clay Content and Thin, Elongated Particles from material sampled from the cold feed or hot bin	No	AASHTO T 304, ASTM D 5821, AASHTO T 176 and ASTM D 4791	1/12,000 tons with a minimum of 1/project/mix type	1/project
Asphalt content	Yes	AASHTO T 164, or MoDOT Test Method TM-54, or AASHTO T 287, or AASHTO T 308	1/Sublot	1/Lot
Asphalt content of RAP	No	AASHTO T 164 ^d	1/4 Sublots	1/project
VMA @ N _{des} gyrations	Yes ^a	AASHTO T 312 and R 35 ^e	1/Sublot	1/Lot
V _a @ N _{des} gyrations	Yes ^a	AASHTO T 312 and R 35 ^e	1/Sublot	1/ Lot
VFA @ N _{des} gyrations	No ^a	AASHTO T 312 and R 35 ^e	1/Sublot	1/ Lot
Theo. max SG of the mixture	No	AASHTO T 209	1/Sublot	1/ Lot
TSR of the in place mixture ^f	No ^c	AASHTO T 283	1/12,000 Tons or fraction thereof	1/48,000 Tons or 1/project combination

^a Based on the average of a minimum of two compacted specimens.

^b Core samples shall consist of one core. Up to two additional cores may be obtained at the same offset within six feet of the randomly selected location. If more than one core is obtained, all cores shall be combined into one sample.

^c Payment will be based on the table in Sec 403.23.5.

^d Other methods may be approved by establishing correction factors for RAP from the same source.

^e AASTHO T 331 shall be required when absorption of the specimens are greater than 2.0 percent and may be substituted for AASTHO T 166.

^f In addition to TSR testing, HWT shall be used to evaluate moisture susceptibility for acceptance when other hard durable aggregates are used in lieu of either crushed porphyry or steel slag.

403.19.3.1 Test Method Modification.

403.19.3.1.1 Binder Ignition Modification. Asphalt content determination in accordance with AASHTO T 308, Section 6.9.1 shall be modified by adding the following: If the calibration factor exceeds 1.0 percent, lower the test temperature to 800 ± 8 F and repeat test. Use the calibration factor obtained at 800 F even if it exceeds 1.0 percent. If RAP is used, the binder ignition oven shall be calibrated in accordance with MoDOT Test Method TM 77. At the engineer's discretion, testing may be waived when production does not exceed 200 tons per day. The contractor shall certify the proper proportions of a previously proven mixture were used.

403.19.3.1.2 Rice Test. When the water absorption of any aggregate fraction is greater than 2.0 percent, the test method for determining theoretical maximum specific gravity, AASHTO T 209, shall be modified as follows: After completing the procedure

in accordance with Section 9.5.1 or 9.5.2, drain water from the sample. To prevent loss of fine particles, decant the water through a paper towel held over the top of the container. Spread the sample before an electric fan to remove surface moisture. Weigh at 15-minute intervals, and when the loss in mass is less than 0.05 percent for this interval, the sample may be considered to be surface dry. This procedure requires about 2 hours and shall be accompanied by intermittent stirring of the sample. Break conglomerations of mixture by hand. Take care to prevent loss of particles of mixture. Calculate the specific gravity of the sample by substituting the final surface-dry mass for A in denominator of Equations 2 or 3.

403.19.3.1.3 Mixture Bulk Specific Gravity. Determining bulk specific gravity using paraffin-coated specimens, AASHTO T 275, shall not be used when required by AASHTO T 166. Alternate methods are AASHTO T 331 and ASTM D1188. The surface of specimens prepared for testing by these methods may have the surface texture removed by sawing a minimal amount. Specimens shall be securely held in a jig or other clamping device to eliminate distortion and retain a face parallel to the original surface. Measurements for lift thickness shall be made prior to sawing.

403.19.3.1.4 BMD SP095 and SP125 Mix Sampling and Specimen Fabrication. BMD loose mix shall be sampled at the plant by the contractor during production in accordance with AASHTO R 97 and split to the appropriate size in accordance with AASHTO R 47. After QC has been notified of the random sample, the first truck shall be sampled as directed by the engineer. If the random number for multiple tests overlap, the contractor shall complete the first testing requirements and then immediately proceed with the second testing requirements.

The contractor shall wait 30 minutes after sampling loose mix before fabricating specimens for CT_{Index}, RT_{Index} and HWT (including HWT moisture susceptibility) testing. Loose mix temperatures shall not drop below the molding temperature. The 30 minutes shall start when all the material for the loose mix sample has been obtained and the time this occurs shall be recorded. All specimens shall be fabricated as soon as possible after the 30-minute delay. QC and QA samples shall be sampled and fabricated at separate random times.

The following table details the minimum number of specimens required for QC or QA testing:

Test Method	Minimum Number of Specimens ^e
Cracking Tolerance Index (CT _{Index})	5 Compacted Specimens
Rutting Tolerance Index (RT _{Index}) ^{a,b}	3 Compacted Specimens
Retained Loose Mix ^c	125 lbs
% Asphalt Content	1 Sample
Theo. Max SG of mixture, Gmm	1 Sample
% Air Voids	2 Compacted Specimens
Retained Loose Mix ^c	30 lbs
Tensile Strength Ratio (TSR) ^d	250 lbs

^a Retained loose mix for Hamburg verification of mixture not meeting minimum RT_{Index} thresholds.

^b HWT may be used in lieu of the RT_{Index} tests or a RT_{Index} correlation. Four (4) compacted 62 ±1mm specimens shall be fabricated.

^c Retain loose mix material for dispute resolution. The loose mix shall be stored in a climate-controlled environment.

^d HWT may be used in lieu of TSR tests in accordance with MoDOT TM-100.

^e Compacted test specimens shall be allowed to cool to 77 ± 5 F prior to determining the air void content. After sample fabrication, the samples shall be stored in a climate-controlled environment and tested within 7 days.

403.19.3.1.5 Performance Test Reporting. CT_{Index} testing shall be performed on five compacted specimens. All five results shall be reported. The average CT_{Index} shall be calculated after discarding the highest and lowest CT_{Index} values. The average CT_{Index} shall be used to determine acceptance. RT_{Index} testing shall be performed on three compacted specimens and the average result used to determine acceptance. HWT testing shall be performed on four compacted specimens and the average result used to determine acceptance.

Compacted specimens for CT_{Index} , RT_{Index} and HWT testing shall be selected at random.

After sample fabrication, the samples shall be stored in a climate-controlled environment and tested within 7 days from when the specimens were compacted.

Compaction temperature, times in and out of the oven, gyratory specimen weights and times, and sample identification shall be recorded.

403.19.3.2 Miscellaneous Applications.

403.19.3.2.1 Small Quantities. Small quantities are less than 6000 tons for each separate mixture. This applies to individual projects, individual projects in combination contracts or projects with short discontinuous sections. The contractor has the option to use all testing frequencies in accordance with Sec 403.19.3 or the following shall apply:

- (a) A field laboratory will not be required for monitoring mixtures. All required QC and QA testing shall be performed in an approved laboratory.
- (b) Performance Tests (CT_{Index} , RT_{Index} , HWT and TSR) are not required for BMD SP095 and SP125 mixtures.
- (c) QC tests required in Sec 403.19.3 shall be performed at a frequency of no less than one per day if production does not exceed 1000 tons and at a frequency of no less than two per day if production exceeds 1000 tons. Independent or retained sample QA tests shall be performed at least once per project, as indicated.

403.19.3.2.2 Base Widening and Entrances. For base widening mixture and entrance work, the following will apply:

- (a) All base widening shall be constructed in accordance with Sec 401.7 and subsections.
- (b) The minimum density of these mixtures shall be attained as specified herein, except, compaction may be performed in accordance with Sec 403.15.3.

403.19.4 Dispute Resolution. When there are significant discrepancies between the engineer's and the contractor's test results, dispute resolution procedures will be used.

403.19.4.1 Cease Work. The contractor's operations may be required to cease until the dispute is resolved if the test results indicate the mixture is subject to failure.

403.19.4.2 Third Party Resolution. The first step in dispute resolution will be to identify differences in procedures and correcting inappropriate procedures before moving to third party resolution. If that does not resolve the dispute, either the contractor or the engineer may request the approved QC Plan third party involvement. The recommendations of the approved third party shall be binding on both the engineer and contractor.

403.19.4.2.1 Dispute Resolution for BMD SP095 and SP125 Test Results. If QA and QC results for CT_{Index} or RT_{Index} do not compare favorably according to Sec 403.23.9.1.2, the first step will be to identify differences in procedures, including specimen aging. If that does not resolve the dispute, the QA CT_{Index} result shall be averaged with the QC CT_{Index} result to determine pay. If RT_{Index} results are in dispute, QC shall fabricate specimens for Hamburg testing in the presence of the engineer using the retained loose mix material. Compacted specimens shall be submitted to a third-party laboratory for HWT testing. Third-party HWT results shall be used to determine acceptance.

403.19.4.3 Third Party Payment. The contractor shall be responsible for the cost associated with the third party testing and resolution if the final result indicates the engineer's test results were correct. Likewise the Commission will be responsible for the cost associated with the third party testing and resolution when the final result indicates the contractor's results were correct.

403.19.4.4 Other Adjustments. The contractor shall not be entitled to any additional payment for costs incurred due to use of the dispute resolution procedures such as, but not limited to, those for delay, cessation of operations, costs to subcontractors, etc. The engineer may give consideration to adjustment of working days if warranted.

403.20 Surface Smoothness. The finish of the pavement surface shall be substantially free from waves or irregularities and shall be true to the established crown and grade. The pavement surface shall be thoroughly tested for smoothness by profiling or straightedging in accordance with Sec 610.

403.21 General Requirements.

403.21.1 Sequence of Operations. To reduce inconvenience to the traveling public during widening or surfacing, the contractor will not be permitted to place any final surface course until the base widening, the leveling course and the binder course have been completed throughout the entire combination of sections, unless otherwise authorized by the engineer. The proper condition of the base widening, the leveling course and the binder course, at the time of placing the surface course, shall be the contractor's responsibility.

403.21.2 Pavement Marking. If the contractor's work has obliterated the existing pavement marking on resurfacing projects open to through traffic, the pavement marking shall be replaced in accordance with Sec 620.

403.21.3 Surfaced Approaches. At locations designated in the contract or as specified by the engineer, approaches shall be primed in accordance with Sec 408 and surfaced with Type SP125 asphaltic concrete. The asphaltic concrete surface shall be placed in accordance with the details shown on the plans or as specified by the engineer. Approaches shall not be surfaced until after the surface course adjacent to the entrance is completed. Any work required to condition and prepare the subgrade on the approaches will be at the contractor's expense.

403.21.4 Filling Drain Basins. If shown on the plans, existing drain basins shall be filled to the top of the lip with plant mix bituminous base course or asphaltic concrete from the pavement edge to the edge of the shoulder. Any difficulty or delay created by this requirement will be at the contractor's expense.

403.21.5 Pavement Repairs (Blow-Ups). A blow-up will be considered that area where excessive expansion has resulted in distress to the existing pavement. Blow-ups occurring prior to the application of the tack coat on the existing surface will normally be repaired by the Commission. Blow-ups occurring after the application of the tack coat shall be repaired by the contractor by removing the distressed concrete and replacing the pavement in accordance with Sec 613.

403.22 Method of Measurement.

403.22.1 Weight Determination. The weight of the mixture will be determined from the batch weights if a batch-type plant is used, and will be determined by weighing each truck load on scales in accordance with Sec 310 if other types of plants are used. Measurement will be made to the nearest 0.1 ton for the total tonnage of material accepted.

403.22.2 Full Depth.

403.22.2.1 The final driving surface area, for the full depth of the pavement, will be used as the area for all underlying bituminous lifts and will not include the additional quantity needed to construct the 1:1 slope.

403.22.2.2 Final measurement of the completed pavement will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. Where required, measurement of the pavement complete in place will be made to the nearest 0.1 square yard. The revision or correction will be computed and added to or deducted from the contract quantity.

403.22.3 Alternate Overlay.

403.22.3.1 Field Established Quantity. When bid as an alternate to a Portland cement concrete overlay, the contractor shall establish the existing roadway profile and set the final overlay profile. The engineer may adjust the final profile as needed. The tons of hot mix asphalt required will be determined by the engineer from the set or adjusted profile. This quantity will be the field established plan quantity.

403.22.3.2 Overlay Measurement. Final measurement of the completed pavement will be based on the field established plan quantity except for authorized changes during construction. The revision or correction will be computed and added to or deducted from the contract quantity. Measurement of the pavement complete in place will be made to the nearest 0.1 ton.

403.22.4 Pavement Testing. The finished courses shall have the nominal thickness shown on the plans. Tests will be conducted to ensure that each course is being constructed to proper thickness, composition and density. The contractor shall cut samples from any layer of the compacted mixture at locations designated by the engineer. QA samples shall be cut and delivered to the engineer no later than the end of the next day following the laydown operation. If the samples are not cut and delivered as stated, the asphaltic laydown operation may be suspended and a deduction of 5 percent per day of the contract unit price of the representative material may be applied, until samples are cut and delivered to the engineer. Samples may be obtained by either sawing or drilling 4-inch minimum diameter cores. Each sawed sample shall consist of a single piece of the pavement of the size designated by the engineer, but no larger than 12 inches square.

403.22.4.1 Pavement Thickness. Lift thickness may be determined by the average thickness of cores taken for density measurements for each lot. Total thickness samples for new full depth asphalt pavements shall be obtained after all bituminous

construction is completed on the project and shall be taken at locations specified by the engineer. For the purpose of determining the constructed thickness of full depth pavement, cores shall be taken at random intervals in each traffic lane at the rate of one core per 1000 feet or increment thereof, or at any other locations as may be determined by the engineer and measured in accordance with AASHTO T 148. Sections of any asphaltic concrete determined to be 0.5 inches or more, less than the thickness shown on the plans, shall be corrected by the contractor. No payment will be made for any costs incurred by the contractor in correcting pavement deficient in thickness. Each core is representative of the pavement thickness for a distance extending one-half the distance to the next core, measured along centerline, or in the case of a beginning or ending core, the distance will extend to the end of the pavement.

403.22.4.2 Surface Restoration. The surface from which samples have been taken, including those for density measurements, shall be restored by the contractor with the mixture then being produced no later than the next day of plant operation, if construction is still active. If bituminous construction has been completed, the surface from which samples have been taken shall be restored within 48 hours with an approved commercial mixture or with cold patch mixtures acceptable to the engineer.

403.23 Basis of Payment.

403.23.1 Aggregate Variation. Due to possible variations in the specific gravity of the aggregates, the tonnage of mixture used may vary from the proposal quantities. No adjustment in contract unit price will be made because of such variation.

403.23.2 Compacted Samples. Payment for obtaining and delivering samples of compacted mixture from the pavement and replacing the surface for QA testing, or any additional tests as directed by the engineer, will be made per sample at the fixed price specified in Sec 109. No direct payment will be made for samples taken for QC testing.

403.23.3 Payment for Pavement Repairs (Blow-ups). Payment for repairing blow-ups will be made in accordance with Sec 104.

403.23.4 Smoothness Adjustment. The contract unit price for all mixes, except wedge or level course, will be adjusted in accordance with Sec 610.5. The contract unit prices for asphaltic concrete pavement will be considered full compensation for all materials entering into the construction of the pavement and for the cost of the smoothness testing and correction.

403.23.5 Tensile Strength Retained Adjustment for non-BMD Mixtures. The contract unit price of each 12,000 tons or fraction thereof for all mixtures, except BMD SP095 and SP125 mixtures, shall be adjusted based on TSR according to the following:

TSR	Percent of Contract Price
Greater than 85%	103
80-85%	100
70-79%	97
Less than 70%	Remove

403.23.5.1 Moisture Susceptibility Requirements for BMD SP095 and SP125 Mixtures. No TSR price adjustment shall be provided for BMD SP095 and SP125 mixtures.

403.23.6 Unconfined Longitudinal Joint Density Adjustment. The minimum density of all traveled way pavement within 6 inches of a longitudinal joint, including the pavement on the traveled way side of the shoulder joint, shall not be less than 90.5 percent of the theoretical maximum specific gravity for all dense graded SuperPave mixtures and shall not be less than 92.0 percent of the theoretical maximum specific gravity for SMA mixtures. The density of the longitudinal joint when confined will be included in the evaluation of the remainder of the mat. Pay adjustments due to longitudinal joint density will apply to the full width of the lane paved. The average of joint cores from each subplot will determine specification compliance. If payment reductions are necessary, the lowest PF_{Total} shall apply. Adjustments due to unconfined longitudinal joint density will be in accordance with the following table and apply to the subplot from which the core(s) are obtained.

Unconfined Longitudinal Joint Density	
Field Density (Percent of Laboratory Max. Theoretical Specific Gravity)	Percent of Contract Unit Price
SuperPave Mixtures	
≥90.5	PF _{Total} not changed by longitudinal joint density
89.5–90.4	Maximum PF _{Total} = 100%; Correction Required ^a
<89.5	Remove and Replace
SMA Mixtures	
≥92.0	PF _{Total} not changed by longitudinal joint density
90.0–91.9	Maximum PF _{Total} = 100%; Correction Required ^a
<90.0	Remove and Replace

^a Correction requires spraying rapid penetrating emulsion on deficient density areas in accordance with JSP2303. All costs associated with correction shall be at the contractor's expense with no additional payment.

403.23.6.1 Rapid Penetrating Emulsion. Should use of Rapid Penetrating Emulsion (RPE) be necessary for corrective action of longitudinal joint density, RPE shall be in accordance with MoDOT JSP2303 Rapid Penetrating Emulsion (available at: https://epg.modot.org/index.php/Job_Special_Provisions), except that no payment will be made for use of RPE.

403.23.7 CT_{Index} Adjustment for BMD SP095 and SP125 Mixtures. The contract unit price for each 6,000 tons or fraction thereof for BMD mixtures shall be adjusted based on the average CT_{Index} results for the tonnage according to the following table provided that acceptable stability and moisture susceptibility results are obtained. The lower adjusted contract unit price from the CT_{Index} and TSR results shall apply. HWT stability and moisture susceptibility results shall be implemented as a pass/fail basis.

BMD SP095 and SP125 SuperPave Mixtures		
Cracking Tolerance Index (CT _{Index})	Tensile Strength Ratio (TSR)	Percent of Contract Price ^a
100 or Greater	Greater than 85% ^{b,c}	103%
50–99	80–85%	100%
40–49	70–79%	97%

^a The CT_{Index} adjustment only applies if the RT_{Index} or HWT results meet the specification.

^b The HWT moisture susceptibility testing may be used in lieu of TSR in accordance with MoDOT TM-100. Passing HWT results will equate to a TSR greater than 85 percent.

^c If an approved liquid anti-strip is used, the TSR shall be greater than or equal to 80 percent to receive full incentive.

403.23.7.1 Stability Requirements for BMD SP095 and SP125 Mixtures. BMD asphalt mixtures shall pass the stability requirements with a passing RT_{Index} or HWT rut depth criteria in accordance with Sec 403.5.11.2 to receive CT_{Index} incentives.

403.23.7.2 Moisture Susceptibility Requirements for BMD SP095 and SP125 Mixtures. BMD asphalt mixtures shall either meet the above TSR requirements or meet the HWT moisture susceptibility requirements in accordance with Sec 403.5.11.3 to receive CT_{Index} incentives.

403.23.8 Paver Mounted Thermal Profiler Adjustments for BMD SP095 and SP125 Mixtures. The contract unit price for all BMD mixes will be adjusted in accordance with Sec 406. The contract unit prices for asphaltic concrete pavement will be considered full compensation for all materials entering into the construction of the pavement and for the cost of the PMTP testing and correction.

403.23.9 Percent Within Limits. PWL will be based on the mean, standard deviation and quality index of each lot's test results for density, percent asphalt, percent air voids, and VMA (VMA not applicable to BMD mixtures). The upper PWL (PWL_u) and lower PWL (PWL_l) is determined from the table in Sec 502.15.8. Total percent within limits, PWL_t, is: PWL_t = (PWL_u + PWL_l) - 100.

The mean is: $x_a = (\sum x_i)/n$

Where: $\bar{x}_a$ = Average of the individual values being considered
 $\sum x_i$ = The summation of all the individual values being considered
 n = The number of individual values under consideration

The Standard Deviation is: $s = (\sum (x_i - \bar{x}_a)^2 / (n - 1))^{1/2}$

The Upper Quality Index is: $Q_u = (USL - \bar{x}_a) / s$

The Lower Quality Index is: $Q_l = (\bar{x}_a - LSL) / s$

Where: Q_u = Upper Quality Index
 Q_l = Lower Quality Index
 USL = Pay Factor Item Upper Spec Limit
 LSL = Pay Factor Item Lower Spec Limit

403.23.9.1 Quality Level Analysis. The engineer will make the QLA no more than 24 hours after receipt of the contractor's test results, by determining the PWL_t for each designated pay factor item.

403.23.9.1.1 Acceptance. The contractor's test results will be used when applicable to determine the PWL , provided the contractor's QC tests and the engineer's QA tests compare favorably, and provided the engineer's inspection and monitoring activities indicate the contractor is following the approved QC Plan.

403.23.9.1.2 Comparison. Favorable comparison will be obtained when the engineer's QA test results on a production sample are within two standard deviations, or the comparison tolerance, whichever is greater, from the mean of the contractor's test results for that particular lot. Comparison tolerances shall be as follows: air voids within ± 0.5 percent, asphalt content within ± 0.2 percent, density within ± 1.3 percent, and, if applicable, VMA within ± 1.25 percent (VMA not applicable to BMD Mixtures).

For BMD SP095 and SP125 mixtures, QA CT_{Index} results shall be within ± 30 of the nearest QC test result. For the CT_{Index} test, if all QC and QA are greater than 80, then results are considered comparable. QA RT_{Index} results shall be within ± 15 percent of the nearest QC test result. QC and QA RT_{Index} results shall be considered to compare favorably if both QC and QA RT_{Index} results meet specification requirements. QC and QA HWT results shall be considered to compare favorably if both QC and QA HWT results meet specification requirements. Further comparisons may be made by using F & t testing at a significance level of 1 percent as directed by the engineer.

403.23.9.1.3 Outliers. No test result shall be discarded, except individual test results on a lot basis may be checked for an outlier in accordance with the statistic T in ASTM E 178, at a significance level of 5 percent. If an outlier is found, material from the retained QA sample may be tested, in the presence of the engineer, to determine a replacement test value. The replacement test value shall be used in the PWL determination.

403.23.9.1.4 Roadway/Shoulder Lots. For the purpose of QLA, mixture placed on the traveled way and placed on the traveled way and shoulders integrally, shall be accounted for in a regular lot/sublot routine. Mixture placed on shoulders only shall be accounted for in a shoulder lot/sublot routine.

403.23.9.1.5 Random Sampling. For the purpose of QLA, all mixture placed on the roadway shall be subject to random testing, except mixture placed within 6 inches of an unconfined longitudinal joint shall not be subject to evaluation. Random samples taken in the same day may be separated by 200 tons.

403.23.9.2 Pay Factors.

403.23.9.2.1 Pay Factors for non-BMD Mixtures (SP048, SP190, SP250, and SMA). The total pay factor (PF_T) for each lot for non-BMD mixtures will be equal to the weighted sum of the pay factors (PF) for each pay factor item for each lot, and is determined as follows:

$$PF_T = + (0.25) PF_{density} + (0.25) PF_{AC} + (0.25) PF_{VMA} + (0.25) PF_{Va}$$

The PF_T for each lot, on the shoulder or otherwise when the density pay factor is not directly included, will be equal to the weighted sum of the PF for each pay factor item for each lot, and will be determined as follows:

$$PF_T = + (0.3333) PF_{AC} + (0.3333) PF_{VMA} + (0.3333) PF_{Va}$$

The PF for each pay factor item for each lot will be based on the PWL_t of each pay factor item of each lot and will be determined as follows:

$$\text{When } PWL_t \text{ is greater than or equal to } 70: PF = 0.5 PWL_t + 55$$

When PWL_t is less than 70: $PF = 2 PWL_t - 50$

403.23.9.2.2 Pay Factors for BMD SP095 and SP125 Mixtures. The total pay factor (PF_T) for each lot for BMD SP095 and SP125 mixtures will be equal to the weighted sum of the pay factors (PF) for each pay factor item for each lot, and is determined as follows:

$$PF_T = + (0.5) PF_{Density} + (0.25) PF_{Va} + (0.25) PF_{AC}$$

The PF_T for each lot, on the shoulder or otherwise when the density pay factor is not directly included, will be equal to the weighted sum of the PF for each pay factor item for each lot, and will be determined as follows:

$$PF_T = (0.5) PF_{Va} + (0.5) PF_{AC}$$

The PF for each pay factor item for each lot will be based on the PWL_t of each pay factor item of each lot and will be determined as follows:

When PWL_t is greater than or equal to 90: $PF = 0.3 PWL_t + 73$;

When PWL_t is greater than or equal to 70 and PWL_t is less than 90: $PF = 0.5 PWL_t + 55$;

When PWL_t is less than 70: $PF = 2 PWL_t - 50$

403.23.9.2.3 Density Pay Factor. The theoretical maximum specific gravity of the mixture, as determined for each subplot and the bulk specific gravity of no less than one core from each subplot, will be used to perform the QLA for the percent of theoretical maximum density. Thick cores required to be cut in half in accordance with Sec 403.15.4 shall effectively double the number of sublots for cores. When density is not used as a pay factor, additional adjustment of the contract unit price will be based on the table in Sec 403.23.9.4.1(c).

403.23.9.2.4 Asphalt Content Pay Factor. The QLA will be performed using the asphalt content test results from each lot.

403.23.9.2.5 Voids in the Mineral Aggregate (VMA not applicable for BMD Mixtures) and Air Voids Pay Factor. Two gyratory specimens shall be compacted for each subplot and the average of the two specimens will be used to calculate the volumetrics of the subplot. The VMA, VFA, and air voids shall be determined from the gyratory compacted specimens. The VMA and air voids for the QLA shall be those calculated using the combined bulk specific gravity of the aggregate as listed on the approved job mix formula, the average bulk specific gravity of the gyratory compacted specimens and the theoretical maximum specific gravity of the mixture determined for the subplot of material. The aggregate content used for the calculation shall be that determined from field asphalt content testing for that subplot.

403.23.9.3 Removal of Material. All lots of material with a PF_T less than 50.0 shall be removed and replaced with acceptable material by the contractor.

Any subplot of material with a percent of theoretical maximum density of less than 90.5 percent or greater than 98.5 percent shall be removed and replaced with acceptable material by the contractor. For SMA mixtures, any subplot of material with a percent of theoretical maximum density of less than 92.0 percent shall be removed and replaced with acceptable material by the contractor.

Any subplot of non-SMA mixtures with air voids in the compacted specimens less than 1.5 percent shall be removed and replaced with acceptable material by the contractor. Any subplot of SMA mixtures with air voids in compacted specimens less than 2.5 percent shall be removed and replaced with acceptable material by the contractor.

Any material with TSR results below 70 percent or material not meeting MoDOT TM-100 requirements from the HWT shall be removed and replaced with acceptable material by the contractor.

For BMD SP095 and SP125 mixtures, any lots of material with a rut depth greater than 12.5 mm of rutting at the designated number of wheel passes for the contract binder grade shall be removed and replaced with acceptable material by the contractor.

For BMD SP095 and SP125 mixtures, any lots of material with a CT_{Index} less than 40 shall be removed and replaced with acceptable material by the contractor.

No additional payment will be made for such removal and replacement. The replaced material will be tested at the frequencies listed in the applicable portions of Sec 403.19. Pay for the material will be determined in accordance with the applicable portions of Sec 403.23 based on the replacement material.

403.23.9.4 Miscellaneous Applications.

403.23.9.4.1 Small Quantities. Small quantities are defined in Sec 403.19.3.2.1. Unless the contractor has elected to use the normal evaluation in the Bituminous QC Plan for small quantities, the following shall apply for each separate mixture qualifying as a small quantity:

(a) For non-BMD asphalt mixtures, QLA and PWL shall not apply. For TSR incentive/disincentive to apply to non-BMD mixtures, the Bituminous QC plan shall require TSR testing. Price adjustments shall be in accordance with Sec 403.23.5.

(b) For BMD asphalt mixtures QLA and PWL shall not apply. CT_{Index} and RT_{Index} tests are not required for BMD SP095 and SP125 mixtures. A three (3) percent of the contract unit price incentive shall be provided for BMD SP095 and SP125 mixtures that meet the HWT stability and moisture susceptibility requirements in accordance with Sec 403.5.11.2 and Sec 403.5.11.3. For the moisture susceptibility incentive to apply, the Bituminous QC plan shall require HWT stability and moisture susceptibility testing.

(c) All mixtures shall be within the specified limits for VMA, V_a , AC and density. In addition to any adjustments in pay due to profile, the contract unit price for the mixture represented by each set of cores will be adjusted based on actual field density above or below the specified density using the following schedule:

Field Density (Percent of Laboratory Max. Theoretical Density)	Pay Factor (Percent of Contract Unit Price)
For all SP mixtures other than SMA:	
92.5 to 98.5 inclusive	100
90.5 to 92.4 inclusive	Correction ^a
Above 98.5 or Below 90.5	Remove and Replace
For SMA mixtures:	
>94.0	100
92.0 to 93.9 inclusive	Correction ^a
Above 98.5 or Below 92.0	Remove and Replace

^a Correction requires spraying rapid penetrating emulsion on deficient density areas in accordance with JSP2303. All costs associated with correction shall be at the contractor's expense with no additional payment.

403.23.9.4.2 Base Widening and Entrances. For base widening mixtures and entrance work, BMD testing, QLA and PWL will not be required. Payment for these mixtures will be made at 100 percent of contract unit price for material that otherwise meets the specifications.

403.23.9.4.3 Single Lift on Unmilled Surface or Leveling Course Work. For resurfacing projects specifying a single lift on an unmilled surface, surface mixture of 3,000 tons or more, or for leveling course work, the following shall apply to the traveled way mixture. All bituminous mixture QC/QA requirements shall apply, except the density pay factor designated in Sec 403.23.9.2 will not be directly included in the total pay factor. In lieu of that, one density sample shall be taken per subplot and the pay adjustment for density will be made using the table in Sec 403.23.9.4.1(c).

SECTION 406 – PAVER-MOUNTED THERMAL PROFILES

Add Sec 406 as new section:

10/26

406.1 Description. This work shall consist of continuous thermal profiling of the asphalt mat temperature behind the trailing edge of the paver screed plate during placement operations using a Paver-Mounted Thermal Profile System (PMTPS). This work shall be completed in accordance with the general principles set forth in AASHTO R 110 "Standard Practice for Continuous Thermal Profile of Asphalt Mixture Construction", and specifically as stated in the following sections.

406.2 Required Measurements. PMTPS measurements are required on the full width of paving of each asphalt lift required by Sec 403. Collection of data shall include shoulder pavement when placed simultaneously with the mainline. The shoulder paving data will be filtered out using Veta during data processing. PMTPS data collection is not required in the following exceptions:

- (a) PMTPS measurements are not required on auxiliary lane tapers, ramps, shoulders (not paved simultaneously with mainline), cross-overs, non-continuous turn lanes, loops, bypass lanes, acceleration/deceleration lanes, intersecting streets, roundabouts, and partial lane width widenings.
- (b) PMTPS measurements are not required for a total net paving length less than 2 lane miles.

- (c) PMTPS measurements are not required on asphalt lift thicknesses less than 1 inch.

406.3 Equipment Requirements. The PMTPS shall consist of the following components listed.

- (a) Temperature sensor to continuously monitor surface temperature of mat.
 - (1) Longitudinal and lateral surface temperature readings shall be collected at 12-inch or less intervals at all paving speeds with an X-Y accuracy of plus or minus 1 inch.
 - (2) Surface temperatures shall be collected for the full width paved in one pass (including any shoulders paved simultaneously with mainline).
 - (3) Surface temperature sensors(s) shall have a temperature range of at least 140 F to 480 F. Sensory accuracy shall be plus or minus 3.6 F, or plus or minus 2.0 percent of sensor reading, whichever is greater.
- (b) Global Navigation Satellite System (GNSS) receiver to capture coordinates of the surface temperature readings. GNSS accuracy shall be plus or minus 2 inches or less in X and Y directions when intelligent compaction is being used. A base station shall be required at any locations having poor cellular reception to obtain required accuracy. When intelligent compaction is not being used GNSS accuracy shall be plus or minus 4 feet or less in the X and Y directions and ground distance sensor shall be within plus or minus 1/1000 feet.
- (c) Onboard data acquisition with a minimum of the following capabilities:
 - (1) Displays (in real-time) map of the surface temperature readings.
 - (2) Displays total distance, paver speed and location.
 - (3) Reports surface temperature readings and GNSS status.
 - (4) Provides real-time statistical summaries of surface temperature readings.
 - (5) Allows operator to define data lot currently being placed per AASHTO PP 114.
 - (6) Stores data internally until data transfer.
 - (7) Automatically transfers data to cloud storage or other approved methods.

406.3.1 System Setup on Pavers. Pavers shall be instrumented with the PMTP system for the full paving width and shall collect measurements no less than 3 feet and no greater than 12 feet from the trailing edge of the screed plate. Other objects shall not obstruct surface temperature measurements and GNSS accuracy.

406.4 Construction Requirements.

406.4.1 Temperature Verification. Temperature verification shall follow AASHTO R110-22, Section 6 Calibration. A record of each verification shall be submitted to the SharePoint site prior to the start of the project.

406.4.2 Data Management. PMTP data files shall be compatible with the Veta software. The contractor shall supply the engineer with the manufacturer's PMTPS Computer Software 14 days prior to beginning work and until ninety days after completion of all work. If Cloud Storage or Cloud Computing is used, the engineer shall be supplied one user ID with full access for the same time-period specified. If cloud storage is not used Raw PMTP data files shall be downloaded once per day and uploaded to the appropriate MoDOT IC-PMTP SharePoint site before the start of the next day's production. The following data management requirements shall apply:

- (a) The PMTP data files should be directly transferred from cloud storage to Veta. Other methods shall be approved by the engineer.
- (b) The PMTP Veta files shall be appropriately formatted and filtered in accordance with MoDOT IC-PMTP protocol.
- (c) Date and time stamp of PMTP shall be checked and verified to reflect the local time zone for both mapped and exported data.

406.4.3 Quality Control. The following shall apply to the Contractor's Quality Control for PMTP.

- (a) The contractor shall have a properly trained person listed in the QC Plan that has completed a Veta training course within the last 2 years to perform the PMTP data collection and file management for the project.
- (b) The PMTP system shall have a documented annual calibration before beginning construction.
- (c) For each run, the thermal profile shall be divided into 150-foot sublots at the full paving width and partial data sublots as follows:
 - (1) Combine partial data sublots less than 75 feet with the previous data subplot.
 - (2) Treat partial sublots greater than 75 feet as one data subplot.
 - (3) Sublots shall not extend over multiple days, different lifts, or paving directions.
- (d) Veta files shall be completed and uploaded with the appropriate naming convention in accordance with MoDOT IC-PMTPS Protocol. Appropriate naming convention can be found in the IC-PMTP Document Helper. The completed Veta files shall have the appropriate filters applied with the summary data transferred to the Summary Report. An up-to-date Summary Report shall be provided to the engineer two days prior to the 1st and 15th of each month.
- (e) **PMTP Quality Control Plan.** A pre-activity meeting shall be required prior to mainline paving. The PMTP Quality Control Plan shall be submitted to the engineer at least 2 weeks prior to the mainline paving pre-activity meeting. The plan at minimum shall include the following:
 - (1) A list of personnel previously trained
 - (2) Detailed daily verification procedure for checking the RTK-GNSS of PMTP
 - (3) Procedure for downloading PMTP data from the instrument
 - (4) The procedure for training operators or other project staff
 - (5) Detailed daily verification procedure for checking the temperature sensor on the PMTP
 - (6) The name of the designated PMTP Quality Control Technician
 - (7) Procedure for submitting data
 - (8) Contact information for technical support staff
 - (9) Anticipated cellular service and GNSS coverage throughout entire project
 - (10) A list of the control points with either UTM or State Plane Coordinates established by the contractor if a base station is required.

406.4.4 Quality Assurance (QA) Testing. The engineer will use a Forward Looking InfraRed (FLIR) camera to verify the contractor's PMTP system. QA tests shall be taken at random locations twice per day. The contractor shall assist the engineer with the placement of the event marker.

The QA tests using the FLIR data QA tool shall compare favorably, according to the instructions found in the IC-PMTP Document Helper. If results do not compare favorably, the contractor's PMTPS shall be verified by the manufacturer. In the case that the PMTPS is required to be sent off to the manufacturer and the contractor is not able to provide a replacement, the contractor will be allowed to continue paving with the verification by the engineer using a FLIR camera for acceptance only.

406.4.5 Thermal Segregation. Thermal segregation will be calculated by using the Differential Range Statistics (DRS) under the parameters of AASHTO R110 in each 150-foot subplot.

The Veta analysis with the appropriate filters applied shall exclude the following surface temperature readings from each subplot:

- (a) Surface temperature readings less than 180 F.
- (b) Surface temperature readings within 2 feet. prior to and 8 feet. after paver stops that are greater than 1 minute in length.

The thermal segregation categories are based on the Differential Range Statistics (DRS), as shown in the table below.

Differential Range Statistics (DRS)	Thermal Segregation Category
$DRS \leq 25.0^{\circ}\text{F}$	Low
$25^{\circ}\text{F} < DRS \leq 35^{\circ}\text{F}$	Moderate
$35^{\circ}\text{F} < DRS \leq 50^{\circ}\text{F}$	Moderate-High
$DRS \geq 50^{\circ}\text{F}$	Severe

406.4.6 Incentive/Disincentive. Incentive/disincentive adjustments shall be made for each subplot in accordance with the following:

Thermal Segregation Category	Adjustment per 150 ft. Sublot
Low	\$40 Incentive
Moderate	\$40 to \$0 Incentive (Linear)
Moderate-High	\$0 to -\$40 Disincentive (Linear)
Severe	-\$40 Disincentive and Reviewed by Engineer

406.5 Loss of Data. If data collection ceases as a result of circumstances reasonably beyond the control of the contractor, the contractor will be allowed to continue the days paving, but the paved sublots will not be eligible for 406 PMTP Incentive. The engineer must be notified immediately of the issue and shall determine if the contractor has made a reasonable effort to resolve the issue. A meeting with the engineer shall be held to determine how to proceed if the issue is expected to extend into the next day's paving. Failure to notify the engineer of the issue at hand will result in the paved sublots to receive a minus \$40 deduct.

406.5.1 GNSS Obstructions. Isolated areas of GNSS obstruction may be filtered out of Veta at the contractor's choice. These areas shall be identified in Veta and brought to the attention of the engineer. Areas excluded from GPS obstruction shall not exceed approximately 5 percent of the total day's production. It is at the discretion of the engineer to determine if the area exceeds an approximate 5 percent.

406.6 Basis of Payment. No direct payment will be made for compliance with this provision.

SECTION 501 – CONCRETE

Add Sec 501.4.1 through Sec 501.4.1.2 as new sections:

10/26

501.4.1 Curing. Concrete cylinders molded in the field shall be cured in accordance with AASHTO R 100.

501.4.1.1 Standard Curing. Concrete cylinders made for assessing the concrete mix design shall be standard cured. Compressive strength testing shall be performed at 28-days in accordance with AASHTO T 22.

501.4.1.2 Field Curing. Concrete cylinders made for assessing construction activities shall be field cured. Compressive strength testing shall be performed in accordance with AASHTO T 22. Construction activities being assessed may involve, but not limited to, the following items:

- (a) Opening to traffic
- (b) Evaluating bridge deck wet curing
- (c) Form removal
- (d) Discontinuance of cold weather protection

SECTION 610 – PAVEMENT SMOOTHNESS

Delete Sec 610.1 and substitute the following:

1/27

610.1 Description. This work shall consist of measuring the smoothness of the final pavement surface. Smoothness shall be measured using the International Roughness Index (IRI). The requirements of this specification, as further subcategorized herein, shall apply to the following pavement construction/overlay categories:

Category	Description
A	Multi-lift Secs 401 and 403 asphalt full-depth construction or overlays with a total thickness greater than 3 inches.
B	Full-depth concrete pavement construction or concrete overlays, in accordance with Secs 502 and 506 respectively.
C	Multi-lift Secs 401 and 403 asphalt overlays, with a total thickness of 3 inches or less, or single-lift Secs 401 and 403 asphalt overlays preceded by cold milling to a depth of one inch or greater.
D	Single-lift Secs 401 and 403 asphalt overlays not preceded by cold milling to a depth of one inch or greater.

Add Sec 610.1.1 as new section:

1/27

610.1.1 Smoothness requirements for diamond grinding of existing Portland cement concrete pavement that serves as the final surface shall be in accordance with Sec 622.30.

Delete Sec 610.4.1 and substitute the following:

1/27

610.4.1 Smoothness Increments. Length of pavement shall be defined in the following increments for the purpose of smoothness acceptance:

(a) Section – A section is a day’s paving and shall begin and terminate at the construction joints. Interruptions designated by the engineer which cause placement to cease and begin at a new location will be considered as a separate section for that day’s operation if the separate section is greater than 250 feet.

(b) Segment – Sections shall be divided into segments of 0.1 mile lengths with the exception of the last segment. If the last segment is greater than 250 feet and less than 0.1 mile, then the segment shall be measured for smoothness as an independent segment. If the last segment is 250 feet or less, the profile for that segment shall be included in the evaluation for the previous segment. The combined segment IRI shall be weighted for the adjusted length of the segment.

Delete Sec 610.4.2.1 and substitute the following:

1/27

610.4.2.1 Profiling will be applicable to the surface of all the following:

(a) Mainline paving

(b) Auxiliary lanes, turning lanes and ramps for projects or combination of projects, consisting of more than 0.5 miles of total profilable pavement. Profilable pavement is considered any pavement not meeting the exceptions listed in Sec 610.4.2.2 or 610.4.2.3.

Delete Sec 610.4.5 and substitute the following:

1/27

610.4.5 Full Depth Pavement or Multi-lift Asphalt Overlays > 3 Inches. These construction procedures apply to categories A and B described in Sec 610.1.

Delete Sec 610.4.5.4 through Sec 610.4.6.1 and substitute the following:

1/27

610.4.5.4 Method of Correction. Corrective action to eliminate ALRs and improve the average IRI shall be accomplished by a method approved by the engineer. Diamond grinding may be used for bumps, but the use of an impact device, such as a bush hammer, will not be permitted. Total grinding depth shall be limited to ¼ inch. Satisfactory longitudinal grinding is acceptable as the final surface of the corrected pavements. All corrective work shall be completed prior to determination of pavement thickness. The contractor shall reprofile the corrected lengths to verify smoothness compliance and submit an electronic data file in PFF format to the engineer within 48 hours after testing.

Table 1		
Pavement Treatment	Use Table 2 in Sec 610.5.1.2	Use Table 3 in Sec 610.5.1.2
	Posted speed > 45 mph	Posted speed ≤ 45 mph

Type	Maximum Segment IRI (in/mi)	Maximum ALR IRI (in/mi)	Maximum Segment IRI (in/mi)	Maximum ALR IRI (in/mi)
Categories A and B in Sec 610.1				
Full Depth Pavement or Multi-Lift Overlays > 3-inches	80.0	125.0	125.0	175.0
Category C in Sec 610.1	Posted speed > 45 mph and AADT > 3500		Posted speed ≤ 45 mph or AADT ≤ 3500	
Multi-Lift Overlays ≤ 3 inches, or Single-Lift Overlays with Cold Milling ≥ 1 inch	Maximum Segment IRI (in/mi)	Maximum ALR IRI (in/mi)	Maximum Segment IRI (in/mi)	Maximum ALR IRI (in/mi)
	80.0	175.0	125.0	175.0

610.4.6 Multi-lift Overlays ≤ 3 Inches or Single-lift Overlays with Cold Milling ≥ 1 Inch. These construction procedures apply to category C described in Sec 610.1.

610.4.6.1 Quality Control Testing. The requirements are the same as Sec 610.4.5.1, except that segment average IRIs shall meet the threshold requirements in Table 1.

Delete Sec 610.4.7 and substitute the following:

1/27

610.4.7 Single Lift Overlays. These construction procedures apply to category D described in Sec 610.1.

Delete Sec 610.5.1 and substitute the following:

1/27

610.5.1 Fixed Value Improvement. The following basis of payment procedures shall apply to categories A, B and C described in Sec 610.1.

Delete Sec 610.5.1.2 and substitute the following:

1/27

610.5.1.2 Incentives. Incentive payment for smoothness will be paid per Table 2 or Table 3, as applicable to the pavement treatment category described in Sec 610.1. For category A and B incentive, when the posted speed limit is greater than 45 mph, Table 2 applies, and when the posted speed limit is 45 mph or less, Table 3 applies. For category C incentive, Table 3 applies for all routes except that Table 2 applies when both the posted speed limit is greater than 45 mph and the AADT exceeds 3500. Constant-width acceleration and deceleration lanes shall be considered as mainline pavements.

Table 2 – (Category A, B, & C ^a , Posted Speed > 45 mph)	
International Roughness Index, Inches Per Mile	Percent of Contract Price
40.0 or less	105
40.1 - 54.0	103
54.1 - 80.0	100
80.1 or greater	100 ^b

Table 3 – (Category A, B, & C, Posted Speed ≤ 45 mph)	
International Roughness Index, Inches Per Mile	Percent of Contract Price
70.0 or less	103
70.1 - 125.0	100
125.1 or greater	100 ^c

^a For Category C, if AADT ≤ 3500, use Table 3 for any speed limit.

^b After correction to 80.0 inches per mile or less.

^c After correction to 125.0 inches per mile or less.

Delete Sec 610.5.2 through Sec 610.5.2.1 and substitute the following:

1/27

610.5.2 Percent Improvement Adjustment. The following basis of payment procedures shall apply to category D described in Sec 610.1.

610.5.2.1 The contract price for resurfacing will be adjusted based on the improvement in profile index according to Table 4 for each segment with an initial IRI greater than 60 inches per mile. Any segment with an initial IRI less than or equal to 60 inches per mile shall receive no percent improvement price adjustment if the segment IRI after placement of the overlay is also less than or equal to 60 inches per mile. Any segment with an initial IRI less than or equal to 60 inches per mile that has an IRI greater than 60 inches per mile after placement of the overlay shall be paid at 97 percent of the contract unit price for pavement, but no correction shall be required.

Table 4 (Category D – Sec 610.1)	
Percent Improvement (Change in IRI / Initial IRI) X 100	Percent of Contract Unit Price For Pavement
35.0 or greater	103
20.0 to 34.9	100
0.0 to 19.9	97 ^d

^d After correction to 0.0 or greater.

Delete Sec 610.5.3 and substitute the following:

10/26

610.5.3 Marred Surface Deductions. A minimum deduction of 20 percent of the contract unit price of the paving quantities will be made for marred surface areas as defined in Sec 610.4.8. The deduction will be applied to an area of pavement extending from edge of the pavement to a longitudinal joint or between longitudinal joints in that section of pavement affected. If the length of the section affected is less than 15 feet, the deduction will be computed for 15 feet. For asphalt pavement and overlays, the deduct shall apply to the surface course and all sub-courses placed within the bounds of the marred surface area.

SECTION 616 – TEMPORARY TRAFFIC CONTROL

Delete Sec 616.3.3 and substitute the following:

1/27

The contractor shall:

(a) Designate an individual as the Work Zone Specialist (WZS) who is knowledgeable and competent by training and/or certification in the principles of proper temporary traffic control in accordance with Chapter 6 of the MUTCD, and who has the primary responsibility, with sufficient authority, for implementing the traffic management plan and other safety and mobility aspects of the project. The WZS shall be directly involved with daily traffic management, and shall communicate pertinent information with the engineer either in person or via telecommunication. Duties of the WZS shall include monitoring the work zone to ensure an efficient flow of traffic, correcting any failed or misaligned traffic control signs or devices, managing the work zone intelligent transportation systems (WZITS), and recommending traffic management improvements to the engineer. The name, certification, and a 24-hour contact number for the WZS shall be provided to the engineer prior to the start of work. If the contractor makes a change in the designated WZS, the engineer shall be notified immediately. The WZS shall be trained and certified by a qualified person as defined by the Occupational Safety and Health Administration. The WZS shall have a card and/or certificate that includes the WZS's name, instructor's name and title, training entity/agency, date of training, and signature of the instructor. Re-certification of the WZS shall be required a minimum of every four years.

(b) Ensure all contractor personnel are trained in traffic control to a level commensurate with their responsibilities.

(c) Obtain authorization from the engineer for any lane closure or traffic shift at least two working days prior to the planned closure or lane shift. Requests for complete road closures, or any imposition of height, width or weight restrictions shall be submitted to the engineer for approval at least 15 calendar days prior to the planned closure or restriction. The engineer reserves the right to deny any request for lane closure, traffic shift, road closure or restrictions of height, width or weight that the engineer determines could be in conflict with other known or anticipated traffic impacts, including but not limited to, outstanding permits that have been issued by the Commission for oversized or overweight loads.

- (d) Perform quality control of work zones to promote consistency and ensure compliance with contract documents, policies and guidelines.

Delete Sec 616.4.1 through Sec 616.4.1.1 and substitute the following:

1/27

616.4.1 Performance and operational aspects of the WZITS and traffic control devices shall be in accordance with the latest editions of the MUTCD and the Missouri *Quality Standards for Temporary Traffic Control Devices*.

616.4.1.1 All traffic control devices shall be removed as soon as practical when the devices are no longer needed. When work is suspended for short periods of time, traffic control and WZITS devices that are no longer appropriate shall be turned away from traffic, removed or covered. All temporary traffic control and WZITS devices shall be removed after the completion of construction and shall remain the property of the contractor unless specified otherwise. All permanent traffic control devices that are in conflict with temporary traffic control or WZITS devices shall be covered or removed as shown on the plans or as directed by the engineer. Upon completion of the work, all permanent traffic control devices to remain in place shall be restored to original condition.

Delete Sec 616.4.2.4 through Sec 616.4.2.5 and substitute the following:

1/27

616.4.2.4 The contractor shall monitor traffic flow through the project and verify that all traffic control and WZITS devices are in place and functioning properly during both daytime and nighttime conditions, as applicable. If the contractor determines that a deficiency in any traffic control device exists, the contractor shall take corrective action. No additional payment will be made for the corrective action.

616.4.2.5 As soon as possible after observing a traffic control or WZITS deficiency, the engineer will report the deficiency to the contractor, either verbally or in writing. After receiving notification, if the contractor does not make corrections within an agreed upon timeline, order records or suspension of the work may occur. Regardless of the severity of the deficiency, corrections shall be made as soon as possible to maintain a quality work zone.

Delete Sec 616.4.3 and substitute the following:

1/27

616.4.3 Each flagger, automated flagger assistance devices (AFAD) operator, portable signal flagging device (PSFD) operator and pilot vehicle operator shall maintain a valid flagger certification card that certifies the individual has been trained by a qualified person as defined by the Occupational Safety and Health Administration, in the principles and procedures of flagging in accordance with Chapter 6 of the MUTCD. Flagger certification cards shall include the flagger's name, instructor's name and title, training entity/agency, date and signature of the instructor. Flagger certifications shall be provided to the engineer prior to flagging operations. Flagger re-certification shall be required a minimum of every four years. Certifications will not be required in emergency situations that arise due to actions beyond the contractor's control when flagging is necessary to maintain safe traffic control on a temporary basis. All flagging, AFAD, PSFD and pilot vehicle operations shall be in accordance with the MUTCD. Flaggers and pilot vehicles shall be provided as shown on the plans or as approved or directed by the engineer. When not specified in the plans, the contractor may use a (Red/Yellow Lens) AFAD, PSFD or pilot vehicle to supplement the flagging operation upon approval from the engineer. When two-way traffic is maintained over a single lane, each flagger, AFAD operator, if used in tandem, and pilot vehicle operator involved in the traffic flagging operation shall be equipped with a portable, two-way, communication system approved by the engineer. When the AFAD or PSFD are not in use they shall be removed from the roadside.

Renumber Sec 616.5.1.1 as Sec 616.5.2:

1/27

616.5.2 Red or Red and Blue Warning Lights. The contractor may elect to use red or red and blue warning lights in accordance with Missouri law 307.175 RSMo. and the following requirements:

- (a) Use of red or red and blue lights shall be limited to use on a total of two vehicles and/or equipment per work zone and/or project. Red or red and blue lights may only be displayed between dusk and dawn and when the vehicles and/or equipment are stationary.
- (b) Use of red or red and blue warning lights shall be limited to areas in advance of tapers or lane shifts and at the active work location.
- (c) Lights shall be SAE Class 2 or SAE Class 1 with dimming capabilities to minimize glare experienced by travelers.

The awarded contract will serve as a permit by the Commission, granting the prime contractor and approved sub-contractors to utilize red or red and blue lights as required by Missouri law.

Renumber and replace existing Sec 616.5.2, including all subsections with the following:

1/27

616.5.3 Work Zone Lighting Work zone lighting shall be provided between dusk and dawn as specified in Secs 616.5.3.1 and 616.5.3.2 and shall be in accordance with Sec 901.2. Lighting systems shall be positioned such that the lighting systems do not cause glare or hot spots, i.e. concentrated areas of high lighting intensity when compared to the average, for motorists, spillover to adjacent properties or become safety concerns. When work zone lighting is required, a lighting plan shall be submitted to the engineer for review 14 days prior to the start of operations. The lighting plan shall show the areas to be illuminated, the type and layout of the lighting systems and calculations of average maintained footcandles.

616.5.3.1 Work area lighting shall be provided in areas where construction equipment and labor are active. Lighting shall provide a minimum maintained intensity of 5 footcandles.

616.5.3.2 Overhead lighting shall be provided for flaggers and other specified locations shown on the plans. Lighting in these areas shall provide a minimum maintained intensity of 5 footcandles.

616.5.4 Sequential Flashing Warning Lights. Sequential flashing warning lights shall be placed within the merging taper and communicate with other lights within the sequence. The lights shall be capable of being spaced at least 60 feet apart with an offset capability of at least 6 feet.

Sequential flashing warning lights shall consist of a single unit (head and housing).

Delete Sec 616.7 through Sec 616.7.2 and substitute the following:

1/27

616.7 Changeable Message Signs. The contractor shall place the changeable message sign (CMS) at the location shown on the plans, WZITS Plan or as directed by the engineer. The CMS shall not be located in the median. CMS used on roadways with speed limits of 55 mph or higher shall be visible from ½ mile under both day and night conditions. The message shall be designed to be legible from a minimum of 600 feet for nighttime conditions and 800 feet for normal daylight conditions.

616.7.1 The contractor shall deploy, operate and maintain the CMS as specified in the traffic control plan or the WZITS Plan, and in accordance with the manufacturer's recommendations for the duration of the project at the contractor's expense. The contractor shall program the CMS as directed by the engineer.

616.7.2 When a CMS with Communication Interface is specified in the contract, the contractor shall operate and maintain the CMS, including setting up initial communications and paying all monthly communications fees. The contractor shall furnish the telephone number and contact information for the contractor's work zone specialist who will promptly program the CMS board remotely under the direction of the engineer. The contractor shall not activate the CMS on right of way until the Communication Interface is functional.

Delete Sec 616.8 through Sec 616.8.1 and substitute the following:

1/27

616.8 Work Zone Traffic Signals. Work Zone Traffic Signals (WZTS) provide temporary traffic control to alternate one-way traffic flow through the work zone by use of a temporary traffic signal and lighting in accordance with Sec 902.3, or a portable traffic signal programmed for two-phase operation. WZTS shall be in accordance with the provisions of this section. Unless otherwise shown on the plans, the contractor may choose either method to fulfill the WZTS requirement.

616.8.1 The contractor shall notify the engineer at least 48 hours prior to the WZTS installation. After installation, the contractor shall receive approval from the engineer prior to activating the WZTS system. The contractor shall provide a service technician to be available for day, night and weekend trouble calls as required under test period requirements in Sec 902. The contractor shall furnish the telephone number or other contact information where the technician can be reached.

Delete Sec 616.8.1.3 through Sec 616.8.1.4 and substitute the following:

1/27

616.8.1.3 The contractor shall provide uninterrupted WZTS traffic control, for travel through the work zone while travel is restricted to alternating one-way traffic flow. During any period of time the WZTS is inoperable and one-way travel is restricted to alternating one-way traffic flow, the contractor shall provide flaggers at the contractor's expense.

616.8.1.4 The contractor shall furnish signal timing, programming, and vehicle detection locations, if required, to the engineer for approval prior to activation of the WZTS. The contractor shall ensure the approved signal timing is provided for the duration of the project. The contractor shall furnish adjustments to the signal timing, programming, and vehicle detection locations to the engineer for approval prior to relocation of the WZTS and prior to adjustments identified by the contractor or engineer.

Delete Sec 616.8.1.6 and substitute the following:

1/27

616.8.1.6 Measurement of WZTS systems, consisting of all lighting and traffic signals at both ends of a one-lane, two-way section, will be made per each.

Delete Sec 616.8.3 and substitute the following:

1/27

616.8.3 Portable Traffic Signals. Portable traffic signals shall be in accordance with Sec 1063. The contractor shall place the portable traffic signal (PTS) units a minimum of 6 feet beyond the edge of shoulder at the location shown on the plans or as directed by the engineer. Each unit shall be level to the satisfaction of the engineer. Each PTS shall be delineated with a minimum of five channelizers. The PTS shall not be located in the median.

Add Sec 616.11 as new section:

1/27

616.11 Work Zone Intelligent Transportation System Plan. The contractor shall submit to the engineer for approval a written and illustrated WZITS Plan three (3) weeks prior to mobilization of any component of the WZITS system. The WZITS Plan shall include the items specified in the contract documents. The Contractor shall not perform any work impacting traffic until the WZITS Plan is in place, activated and approved by the engineer.

General items that shall be included in every WZITS plan are as follows:

- (a) Proposed WZITS field device locations,
- (b) Existing permanent dynamic message signs (DMS) owned and operated by MoDOT located within the project limits, and the first DMS upstream of the project facing motorists approaching the project site within the first 50 miles from the project,
- (c) Traffic control plans for the installation of WZITS field devices,
- (d) WZITS device manufacturer's data sheets,
- (e) Identification of power sources where needed, and
- (f) Documentation of proposed WZITS devices.

Renumber Sec 616.11 as Sec 616.12.:

1/27

616.12 Method of Measurement. Measurement for relocation of post-mounted signs will be made to the nearest square foot of sign area.

Renumber and replace existing Sec 616.12 with the following:

1/27

616.13 Basis of Payment. All temporary traffic control devices authorized for installation by the engineer will be paid for at the contract unit price for each of the pay items included in the contract. No direct payment will be made for the following:

- (a) Furnishing and installing incidental items necessary to complete the work, unless specifically provided as a pay item in the contract.
- (b) Installing, operating, maintaining, cleaning, repairing, removing or replacing traffic control devices.
- (c) Covering and uncovering existing signs and other traffic control devices.
- (d) Relocating temporary traffic control devices, including permanent traffic control devices temporarily relocated, unless specifically included as a pay item in the contract.
- (e) Worker apparel.
- (f) Furnishing flaggers, AFADs, PSFDs, pilot vehicles, and appurtenances at flagging stations.
- (g) Furnishing, installing, operating, maintaining and removing construction-related vehicle and equipment lighting.
- (h) Construction and removal of temporary equipment crossovers, including restoring pre-existing crossovers.
- (i) Furnishing and maintaining work zone lighting and work area lighting.

(j) Furnishing and maintaining continuous power source for temporary traffic control and WZITS devices.

(k) Developing and furnishing Work Zone Intelligent Transportation System Plan.

SECTION 620 – PAVEMENT MARKING

Delete Sec 620.20.3.2.1 and substitute the following:

10/26

620.20.3.2.1 Description. This work shall consist of furnishing and placing chevron and diagonal markings, crosswalks, stop lines, arrows, words and symbols in accordance with the manufacturer's recommendations at locations shown on the plans or as directed by the engineer. Glass beads, when required, shall be in accordance with Sec 620.30.

Delete Sec 620.20.4.3 and substitute the following:

10/26

620.20.4.3 Where required, measurement of non-linear durable intersection markings will be made per each.

SECTION 901 – HIGHWAY LIGHTING

Delete Sec 901 and substitute the following:

1/27

901.1 Description. This work shall consist of furnishing and installing lighting equipment and material as shown on the plans. All work shall meet NEC, NESC and NEMA standards. Existing lighting shall be maintained in effective operation by the contractor except for shutdowns with approval from the engineer for alterations or final removal.

901.2 Temporary Lighting.

901.2.1 Temporary lighting shall consist of furnishing, installing and maintaining wood poles where required, luminaires, bracket arms where required, other lighting support and mounting equipment or installation on existing lighting poles, power cable, connection to a power source, mounting hardware and all other material necessary to provide the temporary installation as shown on the plans. Any Commission furnished items shall be installed by the contractor. Temporary lighting specified as part of a temporary signal installation shall be installed on the signal poles unless otherwise shown on the plans.

901.2.2 Temporary luminaires shall be equipped with an LED emitter and provide a nominal 16,000 initial lumens unless otherwise specified on the plans, with a Type III medium distribution, semi-cutoff light distribution and a B.U.G. rating of 2-0-2, or better. Luminaires shall be mounted 30 feet above the pavement and horizontal unless otherwise shown on the plans. Bracket arms where required shall be oriented at right angles to traffic flow unless otherwise shown on the plans. Photoelectric controls shall be provided and may be installed in the luminaires or in a separate control box at the option of the contractor, unless otherwise shown on the plans. Any existing lighting shall not be taken out of operation until the temporary lighting is ready for operation and with approval from the engineer. All temporary lighting equipment shall be removed by the contractor after the new installation is in operation or as directed by the engineer. Contractor furnished equipment that will remain the property of the contractor may be new or used stock. Contractor furnished equipment that will become the property of the Commission shall be of new stock and shall meet all applicable specifications. Commission owned equipment will remain the property of the Commission and shall be disposed of as shown on the plans or as directed by the engineer.

901.2.3 The contractor shall pay all electrical costs incurred by operation of the temporary lighting until the lighting is removed or until the lighting is accepted for maintenance. For temporary lighting installations where there is not an existing power supply, the contractor shall make any necessary arrangements for providing power to the temporary lighting. Portable generators may be used to provide power to temporary lighting, but any failure of the lighting system due to generator failure will be considered a malfunction as specified in Sec 901.13. No direct payment will be made for power costs. All wire and cable for temporary lighting shall be suspended overhead with proper clearance or buried as shown on the plans.

901.2.4 Temporary lighting shall be installed to meet the construction schedule. The contractor shall maintain the lighting in proper operating condition in accordance with Sec 901.13. Any damage to the lighting installation shall be repaired by the contractor at the contractor's expense.

901.3 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section/Specification
Concrete	501

Reinforcing Steel for Concrete	1036
Wood Poles for Power Supplies and Temporary Installation	1050
Electrical Conduit	1060
Electrical Conductors	1061
Pull and Junction Boxes	1062
High-Strength Bolts, Nuts and Washers	1080
Carbon Steel Bolts, Nuts and Washers	1080
Galvanized Coating of Steel Lighting Poles and Appurtenances	1080
Lighting Equipment	1091
High-Strength Anchor Bolts and Nuts	ASTM F1554, Grade 55
Structural Low Alloy Steel for Base Plates	AASHTO M 270, Grade 50 (ASTM A709, Grade 50)
Stainless Steel Bolts, Screws and Washers	ASTM A193, Grades B5, B6, B7 or B16
Stainless Steel Nuts	ASTM A194
Circular Steel Pile Foundation	ASTM A252, Grade 2 or ASTM A500, Grade B/C
Steel H-Pile Foundation	ASTM A709, Grade 36
Screw Anchor Foundation Shaft	ASTM A252, Grade 2 or ASTM A500, Grade B/C
Helix	ASTM A575, Grade M 1010 or AASHTO M 270, Grade 36 (ASTM A709, Grade 36)
Helix Core	ASTM A575, Grade M 1023 or AASHTO M 270, Grade 36 (ASTM A709, Grade 36)
Connector Plates and Steel Closure Plates for Circular Pipes and Connector Plates for H-Pile and Screw Anchor Foundations	AASHTO M 270, Grade 36 (ASTM A709, Grade 36)

901.3.1 Anchor bolts, bolts, nuts and washers specified to be galvanized shall be galvanized in accordance with ASTM F2329. Except for anchor bolts, galvanizing thickness shall not exceed 6 mils. For anchor bolts and nuts and for high strength bolts and nuts, except those in accordance with ASTM F3125 Grade A325, the contractor shall furnish to the engineer a test report certified to be the last completed set of mechanical tests for each size in each shipment. For high strength bolts and nuts in accordance with ASTM F3125 Grade A325, the contractor shall furnish to the engineer a copy of the manufacturer's inspection test report for each production lot or shipping lot furnished and shall certify the bolts furnished are in accordance with the specifications. Bolts and nuts in accordance with ASTM A307 shall be accompanied by a manufacturer's statement that the bolts and nuts were manufactured in accordance with ASTM A307.

901.3.2 Concrete shall be of the class specified in the contract. Material, proportioning, mixing, slump and transporting of concrete shall be in accordance with Sec 501 for the specific class specified.

901.3.3 Equipment and material shall be of new stock unless the contract provides for relocation of existing units or use of units furnished by others. New equipment and material shall be listed and labeled by a nationally-recognized testing laboratory, as applicable, and shall meet the approval from the engineer.

901.4 Equipment List. An approved list of lighting equipment is required in accordance with Sec 902.4.5 prior to installation.

901.5 Roadway Lighting Pole Construction Requirements

901.5.1 Lighting Poles. The contractor shall furnish the length of pole and bracket rise shown on the plans. The cable entrance at the bracket arm shall be a field drilled 1 1/4-inch hole. The edges of the hole in steel poles shall be deburred and coated with commercially available inorganic zinc-rich paint. All cable entrance holes shall be fitted with a suitable rubber grommet. A grounding conductor shall provide grounding continuity for all metallic, noncurrent carrying poles in one circuit. The grounding conductor shall be securely connected to the grounding electrode on the supply side at the main disconnect switch.

901.5.1.1 Top Mount Lighting Poles. The contractor shall furnish and install top mount lighting poles in accordance with the manufacturer's shop drawings and project plans.

901.5.2 High Mast Lighting Towers. The contractor shall furnish and install high mast towers that include the required mounting height of luminaires and illumination requirements shown on plans. Towers shall include a head frame and ring assembly with provisions to accommodate the quantity of luminaires shown on plans and equipped with obstruction lights when specified. Towers shall be equipped with an integral winch assembly and, when specified on plans, a compatible, portable winch drive properly selected for the voltage identified on plans. Towers shall incorporate an electrical system that integrates incoming power specified on plans with provisions for winch drive power, traveling cable, and the luminaire ring power distribution. The entire high mast tower shall conform to Sec 1091.

901.5.2.1 High Mast Towers and Foundations. High mast towers shall be installed in accordance with the manufacturers' approved shop drawings.

901.5.2.1.1 Tower Shafts. Tower shaft sections to be telescoped together shall be the sole responsibility of the contractor to verify correct installation, straightness of the tower, and accuracy of the mating surfaces in accordance with the manufacturers shop drawings. All joints shall be sealed with an exterior 100 percent silicone caulk.

901.5.2.1.2 Tower Installation. High mast towers shall be installed at the locations shown on the plans. After erection of each tower with all fixtures and components attached, the straightness and plumbness of the tower shall be checked. The plumbness of the tower shall not vary from the vertical by more than the maximum diameter of the tower through the entire length of the tower.

901.5.2.1.3 Tower Foundations. Anchor bolts, nuts, washers, and templates shall be furnished by the high mast tower manufacturer. After erection and alignment of the tower, the space between the foundation and the bottom of the base plate shall use a galvanized press formed screen of 3 or 4 mesh, minimum 21 gage that is a friction-tight fit.

901.5.2.1.4 Identification Sign. A self-adhesive sign to indicate the high mast tower number shall be provided on each high mast tower. Sign shall be constructed from self-adhesive, Type 3 retroreflective material, 12 X 12 inches, with black letters and numbers on a white background.

901.5.2.1.5 Lowering Device Inspection. The installation and operational checkout of the approved luminaire support assembly and lowering device shall be accomplished at the direction of the manufacturer's authorized representative whose presence shall be arranged for by the contractor. The manufacturer's representative shall have at least 5 years' experience in the manufacturing and installation of lowering devices. This requirement shall apply to not less than two tower systems. Correct operation of each raising and lowering device and all fixtures in the system shall be ensured by the contractor before final inspection is made by the engineer.

901.6 Navigation Lighting. The navigation lighting system shall consist of furnishing and installing all cable, conduit, controllers, lanterns, lamps, supports and all other equipment as shown on the plans. Bridge navigation lights shall be installed in accordance with Title 33 CFR, Part 118, the manufacturer's recommendations and the following:

901.6.1 Lanterns mounted in an inverted position shall have a hole in the tip of the lens to prevent water from collecting in the lantern. Lamps shall be properly installed and oriented for the applications.

901.6.2 As part of the system, a photoelectric cell shall be provided in accordance with Sec 1091. The photoelectric cell shall be mounted on the control station such that all lanterns within the system operate simultaneously and shall illuminate only during hours of darkness or low visibility.

901.6.3 Equipment used for general illumination of the bridge shall be designed such that the light distribution pattern will not permit high-intensity light to spill over and blind or interfere with marine navigation.

901.6.4 The contractor shall maintain navigational lighting on bridges during all construction and provide permanent navigation lighting on the bridge when the bridge spans the river and falsework has been removed. Existing navigation lighting shall remain in use or temporary navigation lighting installed during the construction period as required. Upon the notice to proceed, the contractor shall maintain and operate the navigation lights until the permanent navigation lights are in operation and the test period completed. Temporary lights and reflectors shall be of the same color and characteristic and have a range of visibility equal to that prescribed for permanent navigation lights.

901.6.5 The contractor shall notify the engineer in writing the date the navigation lighting system will be ready for testing. With approval from the engineer, the contractor shall place the navigation lighting system in operation for a 15 consecutive day test period. The test period shall not be started until all lanterns in the system are ready to be tested. The system shall be tested as a unit. Any failure or malfunction of equipment during the test period shall be corrected at the contractor's expense and the navigation

lighting system tested for an additional 15 consecutive day period. This procedure shall be repeated until the navigation lighting system has operated to the engineer's satisfaction for 15 consecutive days.

901.6.6 When the test period is initiated and until completed, the contractor shall provide a service technician in accordance with Sec 901.13.

901.6.7 Before acceptance of the work, the contractor shall furnish the engineer with maintenance information in accordance with Sec 901.15 of all navigation lighting equipment including, but not limited to, lanterns, lamps and auxiliary equipment.

901.7 Power Supply Assembly. The power supply assembly shall consist of all equipment mounted on a service pole, W-beam pedestal or concrete pedestal as shown on the plans. The configuration and installation of the equipment mounted on the assembly shall conform to the plans, Sec 1091.9, and meet the safety requirements and approval of the utility company or municipality furnishing power for operation.

901.7.1 Circuit breaker cabinets and meters shall not be installed on the street or walk side of the pole, pedestal or cabinet.

901.7.2 Meter sockets provided by the contractor shall be UL listed and conform to the requirement of the electrical utility or municipality providing power.

901.8 Rigid Conduit System. Conduit shall be placed as shown on the plans. Rigid conduit shall be installed in accordance with the applicable requirements of Sec 902. Rigid conduit material shall conform to Sec 1060 and shall be the type specified on the plans.

901.9 Trenching and Backfilling.

901.9.1 The depth of trenching and backfilling for conduit and cable-conduit shall be no less than shown on the plans. Conduit or cable-conduit shall not be placed in a trench prior to inspection of the trench by the engineer. All disturbed areas shall be restored to the satisfaction of the engineer.

901.9.2 Type I, 24-inch trenching for cable-conduit will be specified if the excavated material would be classified as Class A Excavation, as defined in Sec 203 and no material is in evidence that might cause mechanical damage to cable-conduit. The cable-conduit shall be laid on the bottom of the trench and the trench backfilled. In lieu of Type I, 24-inch trenching, the cable-conduit may be installed by plowing. The cable-conduit shall be placed at a minimum depth of 18 inches and the soil over the installation shall be recompacted to the approximate original in-place density.

901.9.3 Type II, 24-inch trenching for cable-conduit will be specified if the excavated material would be classified as Class A Excavation, as defined in Sec 203 and material is in evidence that might cause mechanical damage to cable-conduit. Type II trenching will also include trenching in rock embankment. The cable-conduit shall be embedded in sand as shown on the plans and the trench backfilled.

901.9.4 Type III, 21-inch trenching for cable-conduit will be specified if material that would be classified as other than Class A Excavation, as defined in Sec 203, is encountered. The cable-conduit shall be embedded in sand as shown on the plans and the trench backfilled.

901.9.5 Trenches shall be excavated to the width and depth necessary for conduit installation as shown on the plans. All trenches shall be backfilled as soon as practical after the installation of conduit or cable-conduit. Cinders, broken concrete and other hard or objectionable material that might cause mechanical damage to conduit or cable-conduit shall not be used for backfilling to an elevation 12 inches above the top of conduit or cable-conduit. The bottom of the trench shall be free of such material before the conduit is placed. Backfill material shall be deposited in layers not exceeding 6 inches deep and each layer shall be compacted to the approximate density of the adjacent material by an approved method before the next layer is placed. Red burial tape imprinted with "CAUTION - BURIED CABLE BELOW" shall be installed in all trenches and plowing operations at approximately 1/3 to 1/2 of the depth of the trench. If the trench is to be located under a shoulder that is to be stabilized, the trenching, installation of conduit or cable-conduit and backfilling the trench shall be completed before the shoulder stabilization construction is started. Unless the lighting poles are in place, a coil of cable or cable-conduit of sufficient length to reach the proposed handhole shall be buried near each pole location. The coil shall be covered such that damage will not occur.

901.10 Pull and Junction Boxes. Pull and junction boxes shall be installed at locations shown on the plans in accordance with Sec 902.

901.11 Pole Foundations and Installation.

901.11.1 Concrete foundations for ground mounted poles shall be Class B concrete and shall have dimensions no less than shown on the plans. Concrete shall be placed, finished and cured in accordance with the applicable provisions of Sec 703. Forms will not be required for concrete placed below the finished ground line. All conduit and anchor bolts shall be rigidly installed before the concrete is placed. All portions of the anchor bolts extending above the foundation shall be threaded. Anchor bolts shall align with bolt holes on the transformer base or base plate. Installation of poles on integral concrete median and foundations shall be as shown on the plans. The concrete foundation shall be flush with the finished grade or surface and shall not extend above the finished grade on slopes.

901.11.2 Steel circular and H-pile foundations for ground mounted poles shall be installed in a hole of the approximate dimensions shown on the plans and secured by tamped, wet limestone screenings. Steel pile foundations with poles attached may be installed as a unit. The steel connector plate shall be at the proper elevation and properly oriented to receive the transformer base. The connector plate shall be flush with the finished grade or surface and shall not extend above the finished grade on slopes.

901.11.3 The torque for screw anchor foundations shall not exceed the maximum torque rating shown on the fabricator's shop drawings. The steel connector plate shall be at the proper elevation and properly oriented to receive the transformer base. The connector plate shall be flush with the finished grade or surface and shall not extend above the finished grade on slopes.

901.11.4 Leveling and raking of poles on structures may be accomplished by the use of shims, not to exceed a total of 1/2 inch on bolts.

901.11.5 If poles are to be placed on existing foundations or structures with anchor bolts in place, the contractor shall furnish poles with a base plate to fit the anchor bolt spacing.

901.12 Luminaires. Luminaires for roadway lighting shall be adjusted to give proper illumination on the roadway as shown on the plans. Luminaires shall conform to Sec 1091.7.

901.12.1 Luminaires for underpass lighting shall be interconnected with one-inch minimum rigid conduit in accordance with Sec 902 unless other provisions are incorporated into the structure. The contractor shall place the standard identification marker, which is included with the lamp, in accordance with the latest version of ANSI C136.15.

901.13 Circuits. Circuits shall be properly labeled in all handholes, pull boxes and junction boxes by means of round aluminum identification tags with a minimum thickness of 0.1 mil attached to the cables with copper wire. Prior to energizing any circuit, the insulation resistance to ground of each completed lighting circuit shall be tested and shall be no less than 10 megaohms. Any circuit less than 10 megaohms to ground will be rejected.

901.13.1 The contractor shall provide a suitable 1000-volt (minimum) direct current, zero to 100-megohm range resistance measuring device for making the resistance test. The circuit test shall be performed by the contractor in the presence of and documented by the engineer.

901.13.2 After the circuits have been tested and found acceptable, the contractor shall, upon approval from the engineer, energize the lighting circuits for a 15 consecutive day test period. All circuits being energized from a control station shall be tested as a system. The entire system shall be tested as a unit. Any malfunction on any circuit shall be corrected and the system tested for an additional 15 consecutive day period. This procedure shall be repeated until the lighting system has operated to the engineer's satisfaction for 15 consecutive days.

901.13.3 When the test period is initiated and until completed, or following the turn-on of temporary lighting, the contractor shall provide at least one service technician to remain in the area and be available for day, night and weekend trouble calls. The contractor shall furnish the name, address and telephone number where each designated technician can be reached at all times. If the lighting system malfunctions and a designated technician cannot be reached or cannot arrive at the location in a reasonable time in the judgment of the engineer, the engineer may exercise the option to direct MoDOT personnel or a third party to correct the malfunction. If this option is invoked, the entire cost of the work performed by MoDOT personnel or the third party will be computed in accordance with Sec 108.9 and deducted from monies due the contractor. Whether or not the engineer elects to correct the malfunction, nothing in this specification shall be construed or interpreted to relieve the contractor of any liability for personal injury or property damage resulting either directly or indirectly from a malfunction during the test period. The contractor and surety shall indemnify and save harmless the State, the Commission, and the Commission's agents, employees and assigns for any legal liability for such a malfunction.

901.14 Installation of Cable and Cable-Conduit.

901.14.1 Cable-conduit shall be installed in a trench of the type specified. Cable-conduit runs shall be continuous without splice between the control panel, handholes, pull boxes, poles and junction boxes. All conduit ends shall be sealed around the cables with a readily workable, soft, electrical duct sealing compound. The compound shall be workable at 30 F and shall not melt or run at

temperatures up to 175 F. Cable-conduit shall be allowed to "snake" in the trench, but there shall be no sharp bends and if two or more cable-conduits are placed in a common trench, the cable-conduit shall not cross each other. For concrete foundations, rigid conduit of sufficient size to facilitate the pulling of cable-conduit shall be cast in the foundation as shown on the plans. The cable-conduit shall be installed through the rigid conduit. Cable-conduit shall extend a minimum of 18 inches above the top of the foundation. The conduit of the cable-conduit shall then be cut off circumferentially approximately 6 inches above the base plate in the transformer base or pole, leaving the cables exposed for connection. Where placed under paved roadways, other paved areas and any type of shoulder, the cable-conduit shall be installed in rigid conduit. Standard commercial duct fittings shall be used to connect conduit of cable-conduit to rigid conduit as shown on the plans and the cables shall continue without splice through the conduit to the nearest pole base. The ground wire shall be attached to a ground lug.

901.14.2 Splices shall be made only in pull boxes, junction boxes and pole bases. More than four cables shall not be spliced in above ground tee splices in pole bases and junction boxes immediately adjacent to wall mounted brackets or underpass luminaires. More than three pairs of power cables shall not be spliced at any other location. Straight or line splices shall only be made in pole bases and junction boxes immediately adjacent to underpass luminaires or wall-mounted brackets unless otherwise approved by the engineer. For underpass lighting or wall-mounted brackets, the cables shall continue unspliced to the nearest junction box or luminaire housing if junction boxes are not shown on the plans. Tee splices shall only be made at the locations shown on the plans.

901.14.2.1 Cables shall be continuous and unspliced to the first light pole. Line splicing in all types of poles, above ground junction boxes and luminaire housings shall be accomplished with a pre-molded fused connector assembly. Line splicing in all breakaway pole bases shall be accomplished with a pre-molded fused slip connector assembly as shown on the plans. After a conductor splice is made, the conductor splices shall be insulated with a protective rubber boot designed for the pre-molded connector. All above ground tee splices shall be accomplished with a splice block with a molded plastic insulating cover. Any required taping shall be accomplished with splice tape. All sharp points and edges of the connector shall be padded and all voids filled with extra wraps of plastic tape. Tape shall not be stretched excessively or in such a manner as to cause creeping.

901.14.2.2 Underground cable splices, if specified, shall be made in a pull box. Straight or line splices shall be made with copper-clad pressed sleeves or an approved equivalent. Tee splices shall be made with a pressed sleeve, split or unsplit type, or an approved equivalent. All splices shall be protected with a resin splice kit installed in accordance with the manufacturer's recommendations.

901.14.3 Cable shall be pulled with a minimum of dragging on the ground or pavement. Frame mounted pulleys or other suitable devices shall be used for pulling cables out of conduits into pull boxes. Lubricants may be used to facilitate pulling cable. Slack in each cable shall be provided by coiling 6 feet of cable in each pull box and 3 feet of cable in each junction box. Where cable-conduit enters a pull box, conduit shall be cut away from cables in accordance with Sec 902.

901.15 Maintenance Information. Before acceptance of the work, the contractor shall furnish the engineer four copies of the manufacturers' written instructions for maintenance and operation of all lighting equipment and wiring diagrams of the installation or system. At a minimum, the manufacturer's instructions shall include documented, organized instructions, wiring and component layout diagrams, and parts lists with part numbers.

901.16 Final Clean Up. Final clean up of right of way shall be in accordance with Sec 104.

901.17 Method of Measurement.

901.17.1 Measurement of trenching, including backfilling, except for rigid conduit, will be made to the nearest linear foot along the centerline of the trench. No measurement of trenching will be made for rigid conduit.

901.17.2 Measurement of rigid conduit will be made to the nearest linear foot as shown on the plans. Contract quantities will be used in final payment except as hereinafter provided.

901.17.3 Measurement of power cable, pole and bracket cable, multi-conductor cable, wire and cable-conduit will be made to the nearest 10 linear feet as shown on the plans. Contract quantities will be used in final payment except as hereinafter provided.

901.17.4 Measurement of luminaires and bracket arms, including all required material and hardware, will be made per each as separate items.

901.17.5 Measurement of Type AT poles, including the transformer base and all specified hardware, will be made per each. Foundations for Type AT poles, including all specified material, will be made per each.

901.17.6 Measurement of Type B poles, including all specified hardware, will be made per each. Bridge safety barrier curb blisters will not be measured for payment with the Type B pole.

901.17.7 Measurement of Type MB poles, complete in place, will be made per each as a single item, including the footing and the integral portion of median barrier. No direct payment will be made for the footing or integral portion of median barrier for Type MB poles.

901.17.8 Measurement of top mount lighting poles, including all specified equipment, will be made per each.

901.17.9 Measurement of high mast towers, including all specified equipment, concrete and steel for tower foundations will be made per each.

901.17.10 Measurement of control stations, including all specified equipment, will be made per each.

901.17.11 Measurement of power supply assemblies, including all specified equipment and cable, will be made per each. The conduit attached to the power supply pole or pedestal and any necessary attachment hardware shall be included with the power supply and no direct payment will be made.

901.17.12 Measurement of pull boxes, including all specified material, will be made per each.

901.17.13 For those items on which final payment is based on contract quantities, final measurement will not be made except for authorized changes during construction or where appreciable errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

901.17.14 Measurement of temporary lighting installations will be made per lump sum.

901.17.15 Measurement of navigation lighting systems will be made per lump sum.

901.18 Basis of Payment.

901.18.1 Accepted highway lighting will be paid for at the contract unit price for each of the pay items included in the contract.

901.18.2 If the contract does not contain a contract unit price for Type III Trenching, and material that would be classified as other than Class A Excavation, as defined in Sec 203, is encountered on construction, payment for such trenching will be paid for at the contract unit price of three times the contract unit price for Type II Trenching per linear foot.

901.18.3 Accepted navigation lighting systems, complete in place, will be paid for at the contract unit price. Payment will be considered full compensation for all labor, material and equipment to perform the described work, including, but not limited to, furnishing and installing all cable, conduit, controllers, light fixtures, lamps, and supports.

901.18.4 No direct payment will be made for transformer bases.

SECTION 1015 – BITUMINOUS MATERIAL

Delete Sec 1015.3.1 and substitute the following:

10/26

1015.3.1 Certification. The supplier shall furnish the truck driver a copy of the bill of lading, manifest or truck ticket to be available to MoDOT at the destination prior to unloading. The engineer at the source shall be furnished a copy. The bill of lading, manifest or truck ticket shall provide the following information regarding the shipment: type and grade of material, chemical additives, such as polyphosphoric acid (PPA), used in modification or for cross-linking, specific gravity at 60 F, net gallons, consignee, truck number, identification number, weight of truck before and after loading, destination, date loaded, name and location of the source, and a certification statement. The certification statement shall be signed by an authorized representative of the supplier and shall be substantially as follows:

"This certifies that the bituminous material in this shipment is in accordance with MoDOT specifications for the grade specified and the weights (masses) shown hereon were obtained on MoDOT approved scales and are correct within the specified scale requirements."

Delete Sec 1015.3.7 and substitute the following:

10/26

1015.3.7 Railroad Shipments. For railroad shipments from refineries where inspection is not maintained by MoDOT, the supplier shall sample each car load at the source and submit the sample promptly to the Central Laboratory. A bill of lading or identification sheet shall accompany each sample and contain the following information: car number, type and grade of material, chemical additives, such as PPA, used in modification or for cross-linking, quantity represented, including gross gallons, temperature and

net gallons at 60 F, destination of shipment, project number and consignee. A certification statement as specified in Sec 1015.3.1 shall accompany each sample. Approval of the source may be withdrawn if samples submitted are not representative of the material shipped in the car.

Delete Sec 1015.10.1 and substitute the following:

10/26

1015.10.1 General. Performance graded asphalt binder shall be an asphalt-based binder produced from petroleum residue either with or without the addition of non-particulate organic modifiers, except Re-refined Engine Oil Bottoms (REOB) and Vacuum Tower Asphalt Extenders (VTAE) shall not be used as modifiers. Polyphosphoric Acid (PPA) may be used at a maximum dosage of 0.25 percent by weight of binder to promote polymer cross-linking and interaction. Higher PPA dosages or other types of modifiers used for cross-linking shall be approved by the engineer. The asphalt binder grade shall be as specified in the contract.

SECTION 1040 – GUARDRAIL, END TERMINALS, ONE-STRAND ACCESS RESTRAINT CABLE AND GUARD CABLE MATERIAL

Delete Sec 1040.2.2 and substitute the following:

1/27

1040.2.2 Application for Placement on Qualified List. To become qualified, a written request shall be sent by the supplier to Construction and Materials. The request shall include a “Roadside Hardware Inclusion Certification and Guarantee Statement” and a guarantee that all material to be used in fabrication will be in accordance with MoDOT specifications and pre-approval for any source of material will be received prior to use.

Delete Sec 1040.4.5 through Sec 1040.4.6 and substitute the following:

1/27

1040.4.5 Placement on the Manufacturer Qualified List. To become qualified, a written request shall be sent by the manufacturer to Construction and Materials with the following:

- (a) Completed MoDOT New Product Evaluation form submitted to Construction and Materials New Product Evaluation Group.
- (b) A copy of the manufacturer’s current AASHTO Product Evaluation and Audit Solutions completed testing report with data complying with MoDOT specification.
- (c) A guarantee that all material furnished shall be in accordance with the specification requirements, shall bear a suitable brand identification, and shall be replaced without cost to the commission when not in accordance with the specified requirements.
- (d) Manufacturer must maintain retesting cycle as required by AASHTO Product Evaluation and Audit Solutions Technical Committee.

1040.4.6 Acceptance. Acceptance will be by placement on the Manufacturer Qualified List, and any sampling deemed necessary by the engineer. The contractor or supplier shall provide equipment and personnel required to obtain samples as directed by the engineer.

SECTION 1049 – PRECAST CONCRETE BOX CULVERTS

Delete Sec 1049.4.2 and substitute the following:

10/26

1049.4.2 Special Designs. The producer shall request approval of any modified and special designs which differ from the designs in ASTM C 1577. The request for such modified and special designs shall fully describe any deviations from those standards, including a drawing showing wall thickness, concrete design strength, the type, size and placement of reinforcement, and inside or outside dimensions of both of the box sections. Precast split-box designs in accordance with ASTM C1786 with or without modification are not acceptable.

SECTION 1063 – TEMPORARY TRAFFIC CONTROL DEVICES

Delete Sec 1063.1 through Sec 1063.2 and substitute the following:

1/27

1063.1 Scope. This specification covers material to be used for temporary traffic control and work zone intelligent transportation system (WZITS) devices.

1063.2 General Requirements. All temporary traffic control devices shall be manufactured as shown on the plans and as specified, in accordance with MUTCD requirements and shall be NCHRP 350 or MASH 2016 compliant. The WZITS devices shall be manufactured as shown on the plans and as specified, in accordance with the MUTCD requirements. FHWA Category 1 temporary traffic control and WZITS devices are not required to be crash tested unless modified. Non MASH 2016 FHWA Category 2 temporary traffic control and WZITS devices and appurtenances manufactured prior to January 1, 2023 may be used until January 1, 2026. Non MASH 2016 FHWA Category 3 temporary traffic control and WZITS devices and appurtenances manufactured prior to January 1, 2023 may be used until January 1, 2030. All FHWA Category 2 and Category 3 temporary traffic control and WZITS devices and appurtenances manufactured after January 1, 2023 shall meet MASH 2016 Test Level 3 crash test requirements. Type F three-loop temporary concrete barrier is required to meet NCHRP 350 requirements regardless of manufacturing date and may be used until January 1, 2030. MASH 2016 FHWA Category 4 temporary traffic control and WZITS devices should be used when available. Nominal dimensions will be permitted for dimensional lumber where applicable. All temporary traffic control and WZITS devices shall exhibit good workmanship and shall be free of objectionable marks or defects that affect appearance or serviceability. The brand name or model number shall be permanently identified on each traffic control device.

Delete Sec 1063.5 and substitute the following: 1/27

1063.5 Sequential Flashing Warning Lights. Sequential flashing warning lights shall meet the following requirements:

- a) Number of lens directional faces: 1
- b) Flashing rate per minute: 55 to 75
- c) Hours of operation: dusk to dawn

Delete Sec 1063.6 through Sec 1063.6.1 and substitute the following: 1/27

1063.6 Flashing Arrow Panels. All lamps shall have a nominal 5-inch, 360-degree tunnel visor. A lamp on the back side of the flashing arrow panel shall be continuously energized during operation of the flashing arrow panel. Lamps shall be visible at an angle of 15 degrees to the left and right of center and 4 degrees above and below center during “on” time. The flashing arrow panel shall contain a device to align the arrow panel to oncoming traffic. Arrow panels shall be capable of displaying the flashing arrow, flashing double arrow and four corner flashing caution modes.

1063.6.1 Trailer-Mounted Flashing Arrow Panels. Trailer-mounted flashing arrow panels shall be MUTCD, Type C.

Delete Sec 1063.7 through Sec 1063.7.1 and substitute the following: 1/27

1063.7 Changeable Message Sign. Each portable changeable message sign (CMS) shall consist of a message board, power supply, control systems and mounting and transporting equipment. The unit shall be assembled to form a complete self-contained CMS that can be delivered to the job site and placed into immediate operation. The sign unit shall be capable of operating at an ambient air temperature of -20 to 120 degrees F. and shall not be affected by two-way radio transmissions other than those required to control the CMS.

A CMS shall be permanently mounted on a trailer, truck bed, or truck cab per manufacturer’s recommendations. The CMS must be securely mounted on the support vehicle such that it should remain attached during an impact to the vehicle. If it is mounted on a trailer, the trailer must be capable of being leveled and plumbed.

CMS trailers should be delineated on a permanent basis by affixing retroreflective material, per Sec 1042.2.7 in a continuous line on the face of the trailer as to be seen by oncoming road users.

1063.7.1 Message Board. The message board of each CMS shall be capable of providing three lines of eight individual changeable characters per line. Each character shall be yellow in display on a black background and be a minimum of 18-inches in height.

Delete Sec 1063.7.3 1/27

Delete Sec 1063.8 through Sec 1063.8.1 and substitute the following: 1/27

1063.8 Portable Traffic Signals. Each portable traffic signal (PTS) system shall consist of two trailer-mounted PTS units, a controller assembly and communication link in accordance with this section. Each PTS unit shall consist of signal heads and indications in accordance with Sec 1092, a self-contained power supply, vehicle detection and mounting and transporting equipment. All components shall be capable of operating in a temperature range of -20 to 120 F.

1063.8.1 Controller Assembly. The controller assembly shall be a minimum two-phase, solid-state traffic signal controller with a conflict monitor capable of operating the signals in accordance with MUTCD requirements and NEMA Standard TS1. The controller shall operate as a fully-actuated unit and shall have the capability of being manually operated to display simultaneous red on all phases. The controller shall be capable of red rest during non-actuated periods. Upon detection of a conflict, the system shall change to a solid red clearance interval followed by flashing red.

Delete Sec 1063.8.4 1/27

Renumber existing Sec 1063.8.5 through 1063.8.6 1/27

1063.8.4 Vehicle Detection. Detection shall be provided by one of the non-intrusive vehicular detection methods specified in Sec 902 or temporary loop detectors with the capability of providing coverage for a 6-foot x 30-foot area. Temporary loops shall be preformed at the factory. The temporary loops shall have self-adhesive rubberized asphalt backing, which shall bond to the pavement.

1063.8.5 Support. A factory trained service representative shall be available at the delivery location to provide technical assistance and training, including the installation and operation of software. No additional payment will be made for travel expenses.

Delete Sec 1063.10 and substitute the following: 1/27

1063.10 Radar Speed Advisory System. Each radar speed advisory system shall consist of a radar unit, speed display, speed limit display, power supply and mounting and transporting equipment.

Delete Sec 1063.10.2 through Sec 1063.10.3 and substitute the following: 1/27

1063.10.2 Speed Display. The speed display shall be a minimum of 18 inches high and shall be capable of displaying the radar unit output from 0 to 99 mph.

1063.10.3 Speed Limit Display. The speed limit display shall indicate the work zone speed limit by means of a 36 x 48-inch speed limit sign. The speed limit sign may be comprised of a rigid or roll-up sign or a rigid sign with a variable speed display. The variable speed display shall be a minimum of 18 inches high and shall be capable of displaying two digits.

Delete Sec 1063.10.4 1/27

Delete Sec 1063.11 and substitute the following: 1/27

1063.11 Truck or Trailer Mounted Attenuators (TMA). Each TMA shall have a standard trailer lighting system, including brake lights, taillights, turn signal lights and Federal Motor Carrier Safety Administration identification bar lights. In the operating position, the rear facing of the TMA shall be marked with alternating 8-inch yellow and 8-inch black retroreflective sheeting forming an inverted “V” at the center and slope downward at an angle of 45 degrees toward each side of the unit or a checkered board pattern consisting of 12-inch square red and 12-inch square white retroreflective sheeting. The TMA may be marked with the same operating pattern or red and white DOT conspicuity tape to simulate the looks of a standard van body trailer when traveling. The TMA shall have the same standard trailer lighting system noted above when the unit is in the transport position.

SECTION 1065 – DELINEATORS

Add Sec 1065.5 as new section: 1/27

1065.5 Guardrail Delineators. Acceptance of delineators requires component identification in accordance with Sec 1040.2.7 and certification of compliance with the applicable requirements of Sec 1065.

Renumber Sec 1065.5 as Sec 1065.6: 1/27

1065.6 Retroreflective Sheeting. Retroreflective sheeting shall be permanently affixed to the body of the delineator and follow guidelines in accordance with Sec 1042.2.7.5 for application of sheeting. Manufacturer’s certification shall be provided for delineator sheeting.

SECTION 1081 – COATING OF STRUCTURAL STEEL

Delete Sec 1081.20 and substitute the following: 1/27

1081.20 GALVANIZING STEEL.

1081.20.1 Scope. This specification covers galvanizing new and existing steel and miscellaneous metals.

1081.20.2 Material. All material shall be in accordance with Division 1000, Material Details, and in conjunction with:

Item	Specification
Galvanizing	ASTM A123
Galvanizing Repair using Zinc-Based Alloys	ASTM A780, Annex A1
Galvanizing Repair using Paints Containing Zinc Dust (non-aerosols)	ASTM A780, Annex A2

1081.20.3 Galvanizing Metal. Steel shall be galvanized as shown on the plans and in accordance with this specification. After fabrication and prior to galvanizing, the steel surfaces shall be solvent cleaned in accordance with SSPC-SP1 Solvent Cleaning and then blast cleaned in accordance with SSPC-SP6 Commercial Blast Cleaning requirements. Structural steel beams and girders webs shall remain vertical while being galvanized.

1081.20.4 Galvanized Metal Repair. Galvanized material on which the galvanizing has been damaged shall be repaired in the field, fabrication shop, or at the galvanizing facility by the zinc-based alloy stick method in accordance with this specification or paints containing zinc dust (non-aerosols) may be an acceptable method if approved by the engineer. The zinc-based alloy stick method shall be required for the repair area(s) in contact with vehicular traffic, pedestrian traffic, or in contact with another surface. Paints containing zinc dust shall be applied in two coats and shall leave a minimum of ninety-three (93) percent pure zinc in a dry film. Paints containing zinc dust shall achieve a minimum total of 10 mils dry thickness. Paints containing zinc dust shall pass ASTM B117, 2000 hours of five (5) percent salt spray testing. Required field welds and adjacent areas on which galvanizing has been damaged shall be repaired by one of these repair methods. The galvanized area(s) to be repaired shall be thoroughly cleaned to SSPC-SP3 (Power Tool Cleaning) in lieu of SSPC-SP11 (Power Tool Cleaning to Bare Metal), including the removal of slag on welds. Touch-up of galvanized sheet material less than 3/16 inch shall be repaired by the paints containing zinc dust method. Methods using zinc sprays (aerosols) will not be permitted on any repairs.

1081.20.5 Acceptance Criteria. All galvanized steel products shall be free from any bare steel, blisters, flux deposits, and dross inclusions. The minimum average coating thickness shall be 3.9 mils and the maximum average coating thickness shall be 25 mils. The finished galvanized product shall be uniform in appearance with no lumps, projections, indentations, globules, runs, sags, or heavy build-up at welded joints.

SECTION 1091 – LIGHTING EQUIPMENT

Delete Sec 1091 and substitute the following:

1/27

1091.1 Lighting Poles.

1091.1.1 Pre-Approval. Fabricators shall submit two copies of shop drawings to the engineer. Submittals shall be approved by the engineer in writing prior to fabrication of the lighting poles. Shop drawings shall indicate design details required for pole fabrication, including material grades and thicknesses, welding and orientation of any longitudinal seams. Shop drawings shall provide pole installation and hardware details. Design details for all possible pole combinations shown on the plans may be submitted. Shop drawings stress calculations shall be signed and sealed by a registered professional engineer in the State of Missouri. Upon written approval, pre-approved drawings may be used on any project where the design conditions of the shop drawings are not exceeded.

1091.1.2 Requirements. Lighting poles shall be steel or aluminum in accordance with the contract and shall be of the same material and design throughout the project. Poles shall be of the type shown on the plans. The fabricator may furnish poles with other shapes, gages and dimensions meeting or exceeding those shown on the plans and specifications. All stainless-steel hardware shall conform to ASTM F593. The mounting height of the slipfitter above the pavement and the pole design numbers will be specified by numbers following the pole type designation. Clamps shall be provided for connecting bracket arms (where required) to poles to obtain the specified mounting height. All poles shall have removable raintight metal pole caps. All handhole covers and pole caps shall be attached to the pole with a chain constructed of the same material as the pole and shall be held in place by screws. The screws shall penetrate through the metal cap or cover and pole securely attaching the cap or cover to the pole. The chain shall be capable of supporting at least six times the weight of the cover or cap and be securely attached to the inside of the pole and of sufficient length to allow removal of the cover or cap for maintenance access. An aluminum or stainless steel identification tag with embossed or engraved letters and numbers shall be provided with all poles as shown on the plans. The tag shall be attached to the pole 6 inches above the top of the handhole or 18 inches above the base plate over the transformer base

door. Shims may be used between the pole base or transformer base and the foundation for leveling purposes. Four copies of applicable pre-approved drawings shall be supplied with the poles and shall be provided to the engineer.

1091.1.2.1 Type AT. Each Type AT pole shall be provided with a transformer base in accordance with Sec 901. A grounding conductor shall be attached to the ground lug in each transformer base as shown on the plans.

1091.1.2.2 Type B and MB. Each Type B and MB pole shall have a wiring handhole with a suitable metal cover near the base using a grounding lug inside the pole as shown on the plans. A grounding conductor shall be attached to the ground lug in each pole as shown on the plans.

1091.1.2.3 Top Mount Lighting Pole. Top mount lighting poles shall conform to the Type AT, B, or MB lighting poles as designed in the plans and shall be fabricated with a circumferentially welded top mount and top plate to accept top mounted luminaries. The top mount shall extend 4" above the top of the pole and meet AASHTO loading requirements for the luminaires provided. The top mount shall be made of the same material as the pole shaft, be constructed as a one-piece pole and top mount unit by the manufacturer and have an outside diameter that accepts the appropriate luminaire slip-fitter.

1091.1.2.4 Steel. Steel lighting poles shall be round or octagonal shaft poles. The shaft section shall be fabricated from basic oxygen or open hearth steel sheet, No. 11 gage, as one continuous shaft or as individual segments no less than 10 feet in length, joined together using electrically welded, intermediate, transverse, full penetration, circumferential joints. Each sheet shall be formed into a tube with one continuous-welded longitudinal seam. After manufacture, the material shall have a minimum yield strength of 48,000 psi, including the weld. Poles shall be manufactured with steel shoe bases or base plates attached to the lower end of the shafts and arranged for bolting to a transformer base or to a foundation. All base plates and shoe bases shall be equipped with four cast steel or cast iron nut covers in accordance with AASHTO M 103 or M 105 or four aluminum nut covers and shall have four galvanized or stainless steel screws for securing covers to the pole. Welding and fabrication of the assemblies shall be in accordance with the ANSI/AWS D1.1 *Structural Welding Code-Steel*. All poles, shoe bases, base plates and cast steel or cast iron nut covers shall be fully galvanized after fabrication.

1091.1.2.4.1 For shoe base-type poles, each shoe base shall be a one-piece casting in accordance with AASHTO M 103, Grade 65-35 with four anchor bolt holes. Each shoe base shall consist of a collar, flange and gussets, all integrally cast. Ample fillet radii shall be provided at the juncture of these components to reduce the effects of stress concentration. The flange of the base shall be flat and continuous around the outside of the collar. The base shall telescope from the shaft and be secured by two continuous welds. One weld shall be on the inside of the base at the end of the shaft and the other weld shall be on the outside at the top of the base. The shoe base shall be arranged for bolting to a transformer base or to a foundation.

1091.1.2.4.2 For base plate-type poles, the base plate shall be no less than 13 inches square and no less than 1 1/4 inches thick.

1091.1.2.5 Aluminum.

1091.1.2.5.1 Aluminum lighting poles shall be round shaft poles. Each shaft shall be manufactured as a two-piece pole by the spun drawn method from seamless extruded aluminum tubing, ASTM B 221, Alloy 6063-T6 and shall have a nominal wall thickness for the lower section of 0.250 inch and a nominal wall thickness for the upper section of 0.188 inch. The one-piece shaft for 30-foot mounting height shall have a nominal wall thickness of 0.188 inch, except those with twin-truss type arms shall have a nominal wall thickness of 0.250 inch. Shoe base-type poles shall be manufactured with heavy cast aluminum shoe bases attached to the lower ends of the shafts. Each shoe base shall be a permanent mold casting in accordance with ASTM B 108, Alloy 356.0-T6 and shall be free from cracks, pits and blowholes. The shoe base shall be arranged for bolting to a transformer base or to a foundation. The base shall have four anchor bolt holes, shall be equipped with four cast aluminum bolt covers and shall have four stainless steel fasteners for securing covers to the shoe base. Each shoe base shall consist of a collar, flange and gussets, all integrally cast. Ample fillet radii shall be provided at the juncture of these components to reduce the effects of stress concentration. The flange of the base shall be flat and continuous completely around the outside of the collar. The base shall telescope from the shaft and be secured by two continuous welds. One weld shall be on the inside of the base at the end of the shaft and the other weld shall be on the outside at the top of the base. The base and shaft shall be welded in the T4 temper with filler alloy 4043 and precipitation heat treated, artificially aged, to the T6 temper by an approved method after welding. Welding shall be in accordance with Article 6.9 of AASHTO's *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*.

1091.1.2.5.2 At the fabricator's option, the shafts for aluminum lighting poles may be formed from one piece of aluminum sheet, ASTM B 209, Alloy 5086-H34, having one continuous weld. The one-piece shaft for the 30-foot mounting height shall have a 9-inch diameter at the base and a nominal wall thickness of 0.135 inch. Shafts for 35 to 55-foot mounting heights shall have a 13.4-inch diameter at the base and a nominal wall thickness of 0.135 inch for both sections. Each shoe base shall be a permanent mold casting having an integral cast aluminum riser and shall be in accordance with ASTM B 108, Alloy 356.0-T6 and shall be free from cracks, pits and blow holes. The integral riser shall be designed to slip-fit into the pole shaft a sufficient distance to develop the full strength of the pole. The riser shall be bonded to the shaft with a structural epoxy adhesive that shall develop the strength of the pole. The epoxy shall develop a minimum of 1,200 psi in shear when tested in accordance with ASTM D 1002. The shoe base

shall have four anchor bolt holes, shall be equipped with four cast aluminum bolt covers and shall have four stainless steel fasteners for securing the covers to the shoe base. Each shoe base shall consist of a collar, flange and gussets, all integrally cast. The flange of the shoe base shall be flat.

1091.1.2.6 High Mast Lighting Towers. High mast lighting towers shall consist of furnishing and installing high mast lighting towers complete, in place, including the tower, anchor bolt assemblies, foundations, head frame, luminaire lowering ring, lowering device, electrical equipment, Light Emitting Diode (LED) luminaires and all other fittings, fixtures, and attachments, all in accordance with the details shown on the plans, the applicable sections of Sec 901, and as hereinafter specified. The high mast lighting towers shall be designed and installed to provide the luminaire mounting heights and illumination requirements shown in the plans.

1091.1.2.6.1 Tower Configuration. High mast towers shall be continuously tapered with a round, 8- or 16-sided polygonal cross section and delivered in sections and telescopically joined together by slip-stress-fit method. An expanded lower section at the base is permitted if required to accommodate the mechanical and electrical equipment in the tower base. Each section shall be designed to ensure that slip-fit splices are sufficient length to develop full strength of the assembled tower. Tower sections shall be telescoped such that the splice is equal in strength and rigidity to the remainder of the tower shaft without detracting from the overall appearance of the tower. Telescoping tower sections shall overlap a minimum of 1-1/2 times the outside diameter of the larger section at each joint.) All structural elements shall be fabricated ASTM A572 or ASTM A595 steel with a minimum yield strength of 50 ksi. Tower shafts shall be fabricated from a single thickness steel plate.

1091.1.2.6.2 Each tower section, top flange and base plate shall be permanently marked on the reference line. The required mark locations shall be shown on the baseplate, top plate, and foundation plan details. These marks shall be used in tower assembly and erection alignment. The reference line and anchor bolt orientation shall be parallel to roadway centerline unless otherwise shown on the plans.

1091.1.2.6.3 A reinforced handhole access opening, having a minimum size of 12 by 36 inches, shall be provided in the base of the tower shaft to allow servicing and maintenance. Corners of the opening and door may be rounded. A gasket door with fasteners shall be supplied to secure this opening, capable of being locked with a padlock to be furnished by the engineer. The access opening shall be placed on the side of the tower as shown on the plan view of each tower orientation sketch.

1091.1.2.6.4 Structural Design Requirements. The high mast towers shall conform to the most recent revision of AASHTO LRFD Specifications for Structural Supports for Highway Signs Luminaires and Traffic Signals (including Interim Revisions). The complete tower shall be designed to withstand all loads which the tower will be subjected to in the field, including the loads applied by all material to be attached to the tower together with a wind loading resulting from a 1700-Year MRI basic wind speed of 120 mph (54 m/s). High mast towers shall be designed for an assumed maximum reaction arising from the maximum wind speed (3 seconds gust) as per ASCE-7, 2022. The design shall provide damping for wind-excited oscillation and adequate allowance for related stresses. The design shall conform to any additional requirements shown on the plans. The submitted high mast tower design shall be a tested design.

1091.1.2.6.5 Welding. All welding shall be done by welders certified in accordance with the AWS code. All welding of the tower shaft or its attachments shall be performed in accordance with the current edition of AWS D1.1, Structural Welding Code - Steel and applicable portions of Sec 1080 and the following:

1091.1.2.6.5.1 Complete shop drawings shall be furnished in accordance with Sec 1080.

1091.1.2.6.5.2 All welding within the slip joint area shall be full penetration. Longitudinal seam welds shall be full penetration within 6 inches of circumferential welds at the base plate and at least 6 inches beyond required section overlap at slip joints. Circumferential welds at the base plate and all full penetration.

1091.1.2.6.5.3 Longitudinal welds shall be inspected by ultrasonic or radiographic methods. A random 25 percent of remaining longitudinal seam welds shall be inspected by magnetic particle testing (if partial penetration), ultrasonic, or radiographic methods. The fabricator shall be certified under the AISC certification program as a minimum to the Simple Steel Bridge or Component Fabricator. The engineer shall be notified four (4) working days in advance of radiographic testing so an inspector may be present to interpret and approve the testing and the welds.

1091.1.2.6.5.4 Field welding is not permitted.

1091.1.2.6.6 Galvanizing. Towers, shoe bases, base plates, top plates, cast nut covers, and any other items made from steel shall be hot dip galvanized with 3-mil (minimum) zinc layer after fabrication accordance with AASHTO M 111 (ASTM A 123).

1091.1.2.6.7 High Mast Tower Foundations.

1091.1.2.6.7.1 Anchor bolt size, number, and configuration shall be such to develop the full strength of the tower shaft and connection to the tower base plate. Anchor bolt embedment shall be capable of developing the yield strength of the anchor bolt. All high mast towers shall have a minimum of eight anchor bolts to attach the tower to its foundation. Tower heights at or greater than 100 feet shall have a minimum anchor bolt diameter of 2 inches. Tower heights under 100 feet shall have a minimum anchor bolt diameter of 1 ½ inches. The minimum anchor bolt length shall be 120 inches for 1 ½ inch and 2-inch anchor bolts and 146 inches for 2 1/2-inch anchor bolts. Anchor bolts with diameter and length greater than these may be used. Anchor bolts shall be in accordance with AASHTO M 314 Grade 55 (380) with Supplementary Requirement S1. Nuts and washers for anchor bolts shall be in accordance with AASHTO M 314. The bolts shall have rolled threading for 12 inches on each end. The anchor bolts, nuts, and washers shall be fully hot-dipped galvanized in accordance with AASHTO ASTM A 153.

1091.1.2.6.7.2 The anchor bolt circle diameter shall provide a minimum of 6 inches of clearance from the reinforcing steel cage in order to fit into the drilled shaft foundations. Ring templates shall be used to maintain spacing and alignment of the anchor bolts during construction of the tower shaft. The anchor bolt ring templates shall be attached to the anchor bolts using one set of leveling nuts and two sets of hold down nuts on the template above the shaft, and two sets of nuts on the embedded bottom template. The upper anchor bolt ring template is temporary. The upper anchor bolt ring template shall be removed prior to placing the tower with base plate on the leveling nuts. The length of threads on the top end of the anchor bolts shall be of sufficient length to allow 1/4 the diameter of the bolt to extend through the upper hold down nut. Two top nuts, 2 washers, and one leveling nut shall be used per anchor bolt in the final assembly of the tower to foundation. All anchor bolts, nuts, washers, and templates shall be specified and furnished by the high mast tower manufacturer.

1091.1.2.6.8 Structural Submittals. In addition to requirements described in Sec 1080, the contractor shall submit four sets of welding procedures prepared as a written procedure specification, complete shop drawings, and engineering stress calculations for the towers and anchorages signed and sealed by a registered professional engineer to the engineer for approval prior to ordering the towers and anchor bolts from the manufacturer.

1091.1.2.6.9 Head Frame. The head frame shall consist of a one-piece welded, structural steel assembly with hot dip galvanized finish after fabrication designed to be tenon-mounted to the high mast tower and secured with stainless steel hardware. The head frame assembly shall incorporate no moving parts except for the necessary pulleys, rollers, sheaves, and iris arms which guide the lowering cables and electrical cable during the lowering operation of the assembly. The head frame assembly shall be a top latching design to accommodate three hoist cables used to raise and lower the lowering ring. Three one-piece cast aluminum latch barrels shall be provided on the head frame assembly. Each latch barrel shall be flared to align the latch pin and shall be designed to hold the entire weight of the ring and luminaires. Latches shall be engaged and released by alternately raising and lowering the lowering ring and shall incorporate a reflective indicator flag to permit a person at ground level to determine if the lowering ring is latched. The vertical side plates shall be made of cold-rolled steel and zinc-electroplated per ASTM A 164 and yellow chromate dipped to a smooth surface. A keeper bar shall be positioned at both ends of the assembly to keep the cord in the track during tower erection and during normal operation.

1091.1.2.6.9.1 The hoist cables shall 7x19 stainless steel aircraft cable conforming to MIL-W-83140 and shall be sized to handle all required loading on the cables during the lowering operation and in fixed position. Each lifting cable shall be supported by two sheaves (pulleys) of cast or forged steel and supported by stainless steel shafts. Each hoist cable shall be a continuous from the luminaire ring to the transition assembly.

1091.1.2.6.9.2 The traveling power cord shall be supported by Teflon or Delrin rollers sized for the flexible power cable. Multiple rollers shall be located on a radius on both ends of the assembly to support the power cord in at least a 7-inch bending radius. The head frame shall be equipped with an assembly cover constructed of copper-free spun aluminum, shaped to shed water and attached with stainless steel hardware. All parts of the head frame shall be sealed in such a manner to prevent entrance of dirt, moisture, ice accumulation, nesting of insect or birds, or other contaminants which may be harmful to the operation of the lowering system.

1091.1.2.6.9.3 The head frame shall be equipped with a threaded hub to accommodate a 5/8-inch air terminal rod. When identified on Plans, a 6-foot x 5/8 inch minimum stainless-steel rod conforming to UL 96.

1091.1.2.6.10 Luminaire Ring Assembly. The luminaire ring assembly (lantern carriage) shall include the 4, 6, 8, 10, or 12 luminaire tenon mounting arm brackets fabricated from 2-inch pipe of sufficient strength to support the specified luminaire as shown on the plans. The mounting arms shall be hot dip galvanized in accordance with AASHTO M 111 (ASTM A 123) and shall bolt to the ring with stainless steel hardware.

1091.1.2.6.10.1 The luminaire ring shall be a totally enclosed wireway, which shall serve as a wire raceway for all electrical connections to the luminaires.

1091.1.2.6.10.2 The ring assembly shall incorporate a self-centering system to keep the ring concentric to the tower during the raising and lowering operation. The centering features shall include roller contacts, spring loaded, cast aluminum arms designed

to protect the tower, luminaires, and lamps from damage during raising and lowering of the luminaire ring assembly. The self-centering system shall allow operation in 30 mph maximum wind speed.

1091.1.2.6.10.3 The ring assembly shall be equipped with transition features designed to prevent misalignment of the three hoist cables and prevent the wire rope cable from untwisting under load. Properly sized wire rope thimbles and factory swagged fittings shall be used to attach hoist cables to the ring assembly.

1091.1.2.6.10.4 The ring assembly shall include ratcheting latch cams that will allow the ring to latch if out of level by up to six inches.

1091.1.2.6.10.5 All miscellaneous fittings, fasteners, and hardware shall be fabricated from high corrosion resistant material.

1091.1.2.6.11 Winch Assembly. The high mast tower shall be equipped with an integral winch assembly compatible with an external (portable) drive motor. The winch assembly shall have a load capacity of no less than five times the lifted load and be equipped with a 30:1 worm gear reducer and an internal drag brake on the input shaft to prevent free spooling of the winch drum. The winch drum shall be sized for the length and size of aircraft cable. The winch assembly shall include a receiver bracket designed to accept the portable drive motor assembly with locking provisions to secure drive to the bracket during operation.

1091.1.2.6.11.1 The complete winch assembly, complete with luminaires and associated electrical and mechanical parts, shall be capable of being lowered to not more than 4 feet above ground level for servicing. All mechanisms shall be designed to provide the operator with a positive means of ascertaining when the ring assembly is in the full raised and latched position. During the unlatching sequence, latch barrels shall allow the operator to transfer the load while being a safe 20 feet away from the base of the tower. Winch cable and hoist cables shall not independently rotate. All required pulley rollers or sheaves and associated bearings, bushings, and shafts shall be constructed of high corrosion resistant materials equal to Type C 1018 and yellow chromate zinc plated. All pulleys and rollers attached to the head assembly shall have permanently lubricated bearings or bushings.

1091.1.2.6.12 Portable Winch Drive Motor Assembly. When identified on plans, provide a portable, removeable winch drive motor assembly designed to mechanically interface with the winch assembly and operate the lowering device. The assembly shall consist of a heavy-duty reversing type electric motor with a stalled torque sized at least twice that required to operate the lowering device or 1 hp, whichever is greater. The assembly shall be configured to drive the winch through a torque limiter coupling to limit the drive force on the hoist and winch cables. The assembly shall also be equipped with a backup shear pin designed to shear at a torque level between 50% and 100% over the torque limiter setting. Provide the assembly with a drum switch and 20 feet of power cord for remote operation and a step-down transformer to provide 120V to the motor. The transformer primary shall be rated for voltage as specified on the Plans. The transformer may be unitized into a detachable assembly and connectorized to permit a single winch drive motor assembly to be utilized on high mast assemblies of different voltages.

1091.1.2.6.12.1 The assembly power cord shall be Type SEOOW cable and terminated with a 600-volt, 30-ampere male plug load break disconnect connector. Load break disconnect shall be compatible with the receptacle described in Section 1091.1.2.5.5, correctly configured for phase configuration and equipped with finger drawplate.

1091.1.2.6.13 Electrical Distribution. The high mast tower shall include an integrated electrical system consisting of a base mounted circuit breaker assembly, traveling cable, and ring assembly wiring.

1091.1.2.6.13.1 The main circuit breaker assembly shall consist of a 100-ampere rated circuit breaker enclosure equipped with a 30-ampere circuit breaker that is rated for 14 kAIC and the correct voltage and phasing supplied for the luminaire. The circuit breaker assembly shall be equipped with a pigtail cord and plug to energize the luminaire ring assembly during ordinary operation and the portable winch drive during maintenance operation. The pigtail shall be Type SEOOW cable and a 600-volt, 30-ampere female receptacle load break disconnect connector. The load break receptacle shall be capable of breaking the full load without a disconnect switch. The load break receptacle shall be correctly configured for phase configuration and equipped with finger drawplate.

1091.1.2.6.13.2 Traveling cable shall connect main circuit breaker assembly and the ring assembly. Traveling cable shall consist of #8 AWG multi-wire Type W cable and terminate at the main circuit breaker assembly at the base of the tower with a 600-volt, 30-ampere male plug load break disconnect connector compatible with the receptacle described above. The load break disconnect shall be correctly configured for phase configuration and equipped with finger drawplate.

1091.1.2.6.13.3 The ring assembly shall be equipped with a NEMA 4X junction box to distribute power to luminaire equipment and be equipped with surge protection device rated 20kV/20kA per ANSI/IEEE C62.41. Prewire male inlet load break disconnect to ring assembly wiring to permit the ring assembly to be energized for maintenance activities when lowered to ground level by connecting directly to the main circuit breaker pigtail. The load break disconnect shall be identical to the receptacle installed on the pigtail described above and correctly configured for phase configuration and equipped with a captive cover when not in use. Distribution cable to ring luminaires shall be Type SEOOW.

1091.1.2.6.14 Grounding Rods. Each high mast tower shaft shall be equipped with two grounding connections near the access door. Two 3/4-inch x 10-foot copperclad ground rods, driven the full length and driven a minimum of 6 feet deep, shall be installed at the locations shown on the plans near the underground cable entrance into each tower complete with approved connectors and with AWG #1/0 (min) bare copper leads connected to the grounding lug in the tower shaft.

1091.1.2.6.15 Obstruction Lighting. An obstruction light system shall be provided when required as shown in the plans. Obstruction light system consists of three ring-mounted, steady-burn, red obstruction light units and a ring-mounted controller to ensure obstruction light units are energized when ambient light falls below 30 fc and remain energized until ambient light exceeds 60 fc. LED lamp assembly shall comply with the most recent revision of FAA AC:150/5345-43J, type L-810(L).

1091.2 Transformer Bases. Transformer bases shall be permanent mold castings in accordance with ASTM B 108, Alloy 356.0-T6 and shall be free from cracks, pits and blow holes. The transformer base shall be designed to accommodate and provide access to electrical equipment. The base shall have internal lugs for mounting on a foundation and shall be designed for bolting to the base plate of the lighting pole using flat and lock washers. A grounding lug shall be provided in each base. The access opening shall have a hinged fiberglass or plastic door with a tamper-resistant fastening device. The outside of the door shall be imprinted or adequately labeled with the warning, "DANGER - HIGH VOLTAGE". No direct payment will be made for transformer bases.

1091.3 Circular Steel Pole Foundations. Circular steel pole foundations, the steel connector plate and steel closure plate shall be of the dimensions shown on the plans. The slotted hole may be saw cut or flame cut. All sharp edges shall be ground smooth. The steel connector plate and steel closure plate shall be welded to the steel pole foundation. The foundation assembly shall be fully galvanized after fabrication. Bolts shall project no less than 1/4 inch nor more than 5/8 inch beyond the nut when properly tensioned. Flat and lock washers shall be used for attachment.

1091.4 Steel H-Pole Foundations. Steel H-pole foundations and steel connector plates shall be of the dimensions shown on the plans. The steel connector plates shall be welded to the H-pole foundation. The foundation assembly shall be fully galvanized after fabrication. Bolts shall project no less than 1/4 inch or more than 5/8 inch beyond the nut when properly tensioned. Flat and lock washers shall be used for attachment.

1091.5 Screw Anchor Foundations. Screw anchor foundations and steel connector plates shall be of the dimensions shown on the plans. The slotted hole may be saw cut or flame cut. All sharp edges shall be ground smooth. The steel connector plates shall be welded to the screw anchor shaft. The foundation assembly shall be fully galvanized after fabrication. Bolts shall project no less than 1/4 inch nor more than 5/8 inch beyond the nut when properly tensioned. Flat and lock washers shall be used for attachment.

1091.5.1 Fabricators for screw anchor foundations shall submit four copies of shop drawings to Traffic. Shop drawings shall indicate complete design details required for fabrication, including material grades, dimensions, thicknesses and welding. Shop drawings shall provide installation procedures and indicate the maximum torque ratings of the foundations.

1091.5.2 Submittals shall be approved by Traffic in writing prior to fabrication. Upon written approval, pre-approved drawings may be used on any project where the design conditions of the shop drawings are not exceeded.

1091.6 Bracket Arms. Bracket arms (where required) shall be similar in design to those shown on the plans, arranged for 2-inch slipfitter luminaire mounting, and shall be attached to the poles as shown on the plans. Bracket arms shall be of the same material as the pole. Bracket arm mounting plates shall match the shape of the pole. A one-inch pipe nipple shall be welded in place in the wire entrance hole on the mounting plate. The welds shall be placed on the side of the plate away from the pole. Flat and lock washers shall be used for attachment.

1091.7 Luminaires.

1091.7.1 Pre-Approval. Manufacturers of LED luminaires shall submit a completed New Product Evaluation Form. Family grouping in accordance with LED Lighting Facts is permitted, provided this is clearly indicated on the submittal form, and clearly communicated via a letter that includes detailed calculations relating the tested product to the submitted product. The luminaire size shall be as specified in the contract. A pipe stop shall be included in the assembly to locate the luminaire properly on the bracket arm. Product cutsheets shall be submitted for luminaire, LED light source, LED driver and surge protection device, if applicable. If dimmable LED driver is specified, provide diagrams illustrating light output and input power as a function of control signal. Instructions for installation and maintenance of LED luminaires shall be provided. Summary of luminaire recycled content and recyclability in accordance with the FTC Green Guides, expressed as a percentage of luminaire weight. IES LM-79 luminaire photometric report shall be produced by a test laboratory that satisfies LED Lighting Facts accreditation requirements. The report shall include, name of test laboratory, report number, date, complete luminaire catalog number, description of luminaire, LED light source, LED driver, and Goniophotometry. IES TM-15 Backlight-Uplight-Glare (BUG) ratings shall be for initial (worst-case) values, i.e., Light Loss Factor (LLF) = 1.0. If luminaires are tilted upward for

Energy Star TM-21 calculations, BUG ratings shall correspond to the same angle of tilt.

1091.7.1.1 Lumen maintenance calculations and supporting test data shall be in accordance with LED Lighting Facts guidance, with the exception calculations shall be based on 50,000 cumulative hours of operation with an ambient temperature range of maximum 40°C (104°F) to minimum -25°C (-13°F). Submit completed ENERGY STAR TM-21 Calculator as an electronic excel file. Provide computer-generated point-by-point photometric analysis of maintained light levels. Calculation/measurement points shall be per IES RP-8. Separated vehicular lanes, bikeways, and walkways shall be evaluated separately. Calculations shall be for maintained values, i.e. Light Loss Factor (LLF) < 1.0, where $LLF = LLD \times LDD \times LATF$. Lamp Lumen Depreciation (LLD) shall be 0.90 or the value calculated in the Energy Star TM-21 calculations, whichever is lower. Luminaire Dirt Depreciation (LDD) shall = 0.90 and Luminaire Ambient Temperature Factor (LATF) shall = 0.96. Mesopic multipliers (i.e., effective luminance factors) shall not be used. All values shall assume photopic visual adaptation. Submit IES LM-63 format electronic file containing luminous intensity data associated with submitted LM-79 report(s) and used for point-by-point calculations. Summary of Joint Electron Devices Engineering Council (JEDEC) or Japan Electronics and Information Technology Industries (JEITA) reliability testing performed for LED packages. Summary of reliability testing performed for LED driver(s). Safety certification and file number indicating compliance with UL 1598. Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratory). Documentation supporting any U.S. origin claims for the product, in accordance with FTC guidance.

1091.7.1.2 Before approval and purchase, vendor shall supply luminaire sample(s) identical to product configuration(s) submitted for inspection. Commission may request IES LM-79 testing of luminaire sample(s) to verify performance is within manufacturer-reported tolerances. Electrically test fully assembled luminaires before shipment from factory. After installation, Commission may perform IES LM-50 field measurements to verify performance requirements, giving consideration to manufacturing tolerances and measurement uncertainties as outlined in IES LM-61 and NEMA LSD 63.

1091.7.1.3 Written product warranty shall be of the minimum duration of ten years, and shall cover maintained integrity and functionality of luminaire housing, wiring, connections, LED light source(s) and LED driver(s). Negligible light output from more than 10 percent of the LED packages constitutes luminaire failure. Warranty period shall begin 90 days after date of invoice, or as negotiated by Commission such as in the case of an auditable asset management system. Manufacturer or local sales representative shall provide installation and troubleshooting support via telephone and/or email.

1091.7.2 General Luminaire Requirements.

1091.7.2.1 General. All luminaires shall be LED. Luminaires shall be designed for ease of component replacement and end-of-life disassembly. IES vertical distribution, control of distribution, and lateral distribution shall be set in accordance with the manufacturer's recommendations and as indicated in the plans unless otherwise directed by the engineer. Transmissive optical components shall be applied in accordance with OEM design guidelines to ensure suitability for the environment (e.g., electromagnetic, thermal, mechanical, chemical). LED light source(s) and driver(s) shall be RoHS compliant. Nominal luminaire input wattage shall account for nominal applied voltage and any reduction in driver efficiency due to sub-optimal driver loading. Luminaire shall accept the voltage or voltage range specified at 50/60 Hz, and shall operate normally for input voltage fluctuations of plus or minus 10 percent. All internal components shall be assembled and pre-wired using modular electrical connections. The following shall be in accordance with corresponding sections of ANSI C136.37, wiring and grounding, terminal blocks for incoming AC lines (electrical mains wires), photocontrol receptacle, latching and hinging, mounting provisions, and ingress protection.

1091.7.2.2 Electrical Luminaire shall start and operate in -25°C (-13°F) to +40°C (104°F) ambient temperature range. Maximum rated case temperature of driver and other internal components shall not be exceeded when luminaire is operated in ambient temperature range specified. Wiring inside the luminaire housing shall be protected by suitable heat resistant insulating material. Mechanical design of protruding external surfaces (heat sink fins) shall facilitate hose-down cleaning and discourage debris accumulation. Liquids or other moving parts shall be clearly indicated in submittals, shall be consistent with product testing, and shall be subject to review by Commission. Luminaire designation indicated "ANSI C136.41, 7-pin" on New Product Evaluation Form shall be fully prewired and shall incorporate an ANSI C136.41 compliant receptacle. If a dimmable LED driver is specified, the 0-10V or DALI control wires shall be connected to the receptacle pads as specified in ANSI C136.41; connection of the two remaining pads shall be by Manufacturer, as directed by Commission.

1091.7.2.2.1 Luminaire shall be listed for wet locations by a U.S. Occupational Safety Health Administration (OSHA) Nationally Recognized Testing Laboratory (NRTL), shall have locality-appropriate governing mark and certification, and shall meet the performance requirements specified in ANSI C136.2 for dielectric withstand, using the DC test level and configuration. Luminaire shall meet the performance requirements specified in ANSI C136.2 for electrical immunity, using the combination Enhanced Wave Test Level (10kV/5kA) for whether failure of the electrical immunity system can possibly result in disconnect of power to luminaire. Luminaire shall comply with FCC 47 CFR part 15 interference criteria for Class A (non-residential)

digital devices, and shall comply with section 5.2.5 (luminaires rated for outdoor use) of ANSI C82.77 at full input power and across specified voltage range.

1091.7.2.2.2 Luminaire assembly shall be equipped with an integral dual fuse and holder and replaceable, 20kA/kV surge suppressor that conforms to IEEE/ANSI C62.41 Category A.

1091.7.2.3 Optical System. Luminaire optical system shall employ serviceable LED modules with clear tempered or borosilicate glass lens. Color Rendering Index (CRI) shall be no less than 50. Nominal Correlated Color Temperature (CCT) shall be 3000k with allowable IES LM-79 Chromaticity Values of 2870 to 3220 measured CCT (k) and -0.006 to 0.006 Measured Duv. Luminaire shall have an external label per ANSI C136.15 and shall have an internal label per ANSI C136.22. Luminaire unit shall deliver the specified initial lumen levels at the specified IES distribution as shown on the plans. The product's photometry shall have been tested to IESNA LM-79. The unit shall be certified IP-66 rated.

1091.7.2.4 Environmental. Painted or finished luminaire surfaces exposed to the environment shall exceed a rating of six per ASTM D1654 after 1000 hours of testing per ASTM B117. Each luminaire shall have aluminum housing with two 2-inch slipfitters or one 4-bolt slipfitter or one 2-inch slipfitter with a longitudinal leveling system. The housing shall have a natural aluminum or gray baked enamel finish. The coating shall exhibit no greater than 30% reduction of gloss per ASTM D523, after 500 hours of QUV testing at ASTM G154 Cycle 6. All metal parts, such as springs on the latches and hinges, U-bolts and screws shall be made from non-ferrous metal or stainless steel. All parts of the luminaire shall be fabricated from corrosion resistant material.

1091.7.2.5 Roadway Luminaires. Roadway luminaires shall be LED. Standard roadway luminaires shall consist of a pre-wired unit suitable for bracket arm or pole top mounting as shown on the plans. Each luminaire shall have aluminum housing with two 2-inch slipfitters or one 4-bolt slipfitter or one 2-inch slipfitter. Bracket arm luminaires shall have a longitudinal leveling system. Tilted luminaires shall have provisions for the tilt angle specified on the plans.

1091.7.2.5.1 The roadway luminaire shall not be equipped with a photo control receptacle, unless otherwise shown in the project plans.

1091.7.2.5.2 The roadway luminaire shall have any easy access point for future repairs to the driver.

1091.7.2.5.3 Top Mount Luminaires. Top mount luminaires shall be vertical top mount type (pole top mount) with a slip-fitter that accommodates a standard 2" top mount. The contractor shall coordinate the pole top mount size with the luminaire mount to ensure compatibility. All luminaires shall allow for a tilt angle to be adjusted in the field dependent upon the placement of the pole. All necessary mounting brackets and hardware shall be included in the payment for the luminaire.

1091.7.2.5.3.1 The top mount luminaire shall have pole adapters which allow wires to be fed through without disassembling the knuckle.

1091.7.2.6 Underpass. Underpass luminaries shall be LED. Luminaires for underpass lighting shall consist of a pre-wired unit suitable for surface-mounting on underpass wall or ceiling as specified on the plans and equipped with two 3/4" NPS-threaded conduit entries (suitable for thru-wiring). Mounting configuration shall be provided to provide specified illumination levels at the locations specified in the plans.

1091.7.2.7 High Mast Tower Luminaires. Luminaires for high-mast towers shall be LED and shall consist of a pre-wired unit suitable for arm-mounting on high-mast luminaire ring of a lowering device system or as otherwise indicated on the plans. Housing shall be aluminum and equipped with hinged access to electrical compartment, employing a one-piece closed cell silicone gasketing and stainless-steel hardware. High mast optical system shall exhibit zero upright and shall be rotatable to permit alignment of required distributions with the roadway.

1091.7.3 Navigation. All lanterns shall be weatherproof and operate on a 120-volt system. Lanterns shall be of the fresnel lens-type and shall be fabricated from a corrosion-resistant material. Each lantern shall provide an LED or a standard service lamp with at least four standby lamps controlled by a lamp changer mechanism capable of illuminating the standby lamp after each lamp burnout. Mounting brackets and all accessories shall be provided with each lantern. A swing arm and retrieval chain shall be provided for main channel lanterns to hold the fixture in proper operating position. The swing arm and retrieval chain shall be capable of being locked in both the upright and inverted positions. Mounting brackets shall be fully galvanized or stainless steel, and all hardware shall be stainless steel.

1091.8 Control Stations. Control stations shall consist of all equipment and material necessary for the distribution of secondary electrical power as shown on the plans. Control stations will be specified by the secondary voltage.

1091.8.1 Cabinets. Control cabinets shall be of sufficient size to house all equipment as shown on the plans. All equipment such as circuit breakers, switches, contactors, fuses, photoelectric controls and terminal blocks shall be installed on the panel as shown on the plans. Control cabinets shall have a control panel constructed of the same material as the cabinet. Cabinets shall be NEMA 4, dust-tight, watertight and constructed of 0.125-inch minimum reinforced sheet aluminum alloy and be of clean-cut design and appearance. All hinges, catches and other hardware shall be non-ferrous metal or stainless steel. Cabinets shall have a No. 2 Corbin cabinet lock and provisions for locking with a padlock. Two keys for cabinet locks shall be furnished by the contractor. Mounting shall be as shown on the plans.

1091.8.2 Lightning Arrestors. Lightning arrestors shall be of the rated voltage as shown on the plans.

1091.8.3 Photoelectric Controls. Photoelectric controls shall be of the cadmium-sulfide or solid-state type operating on 120 volts or 240 volts, as shown on the plans and shall operate on a line supply of 50 to 60 hertz. The load capacity of the photoelectric cell relays shall be a minimum of 1,000 watts. Photoelectric cells shall operate a lighting system through mercury load relays or contactors as shown on the plans. The photoelectric cell circuitry shall be designed to be normally closed at night. The photoelectric cell shall be configured such that in the event of failure, the lights shall be on. The turn-on range shall be adjustable from 1.0 to 3.0 footcandle. A turn-on setting of 1.0 footcandle and a turn-off setting of 2.0 footcandles shall be made at the factory. The photoelectric cell shall have a time delay to avoid operation due to lightning and transient light. A suitable bracket for mounting the photoelectric cell shall be provided. The photoelectric cell shall be mounted into a three-prong twist lock socket. All top mount photoelectric controls shall face an open sky and side mount photoelectric controls shall face north. Each photoelectric control unit shall include a lightning arrestor. Test switches used with photoelectric controls shall be three-position switches or two single-pole breakers as shown on the plans. Test switches shall be clearly labeled and mounted in the control cabinet.

1091.8.4 Contactors. Contactors shall be NEMA Type 1 enclosed, magnetic-type, two-pole, single phase for 600 volts, 60-hertz service. The operating coil shall be designed for 120-volt or 240-volt operation as shown on the plans. The contactor shall be electrically held, have the minimum rating and shall be housed in the control cabinet as shown on the plans. Mercury load relays shall be two-pole, normally-open, mercury contact, magnetic-type with load capacity as shown on the plans.

1091.8.5 Circuit Breakers. All circuit breakers shall be molded-case thermal-magnetic circuit breakers conforming to UL489. The number and trip rating of circuit breakers shall be as shown on the plans. All breakers shall be designed for panel mounting with cable connections on the line and load sides. Plug-in breakers shall not be permitted.

1091.8.5.1 Type A Circuit Breakers. Type A circuit breakers shall have a minimum of 18,000 amps alternating current interrupting rating at 240 volts alternating current and 14,000 amps alternating current interrupting rating at 480 volts alternating current. Breakers shall be full-size and designed to accept wire sizes up to 2/0 AWG. Terminals shall be provided for the wire sizes as shown on the plans.

1091.8.5.2 Type B Circuit Breakers. Type B circuit breakers shall have a minimum of 10,000 amps alternating current interrupting rating at 240 volts alternating current. Type B circuit breakers shall have a nominal size no greater than one inch wide by 4 inches high by 3 inches deep. Terminals shall be configured for the wire sizes as shown on the plans. If the breaker terminals are not designed for the required wire sizes, suitable terminal adapters, connectors or terminal blocks shall be used to convert the wire sizes.

1091.9 Power Supply Assembly.

1091.9.1 Disconnect cabinets shall be NEMA 4, dust-tight and watertight. The operating handle shall have full cover interlock to prevent the door from opening when the breaker is on. The enclosure shall have provisions for padlocking the enclosure and for padlocking the switch in the on or off position.

1091.9.2 Meter boxes shall be NEMA 3R or NEMA 4.

1091.10 Cable Splicing.

1091.10.1 Splice blocks shall be designed for the wire size used, shall have one port per wire and the wires secured with set screws. The set screw holes shall be protected with removable plugs.

1091.10.2 Resin splice kits shall consist of a protective plastic case designed for the type of connector used, filled with a resin insulating compound mixed in accordance with the manufacturer's recommendations.